MANUAL OF STANDARDS

FOR

THE DESIGN, CONSTRUCTION AND MAINTENANCE OF WATER, WASTEWATER, RECLAIMED WATER, STREETS AND DRAINAGE SYSTEMS



City of Groveland

Redmond Jones, City Manager

James Huish, Public Services

Director

156 S. Lake Ave. Groveland, FL 34736

ORDINANCE NO. XXXXX

AN ORDINANCE ADOPTING THE CITY OF GROVELAND, FLORIDA, MANUAL OF STANDARDS FOR THE DESIGN, CONSTRUCTION AND MAINTENANCE OF WATER, WASTEWATER, RECLAIMED WATER, STREETS AND DRAINAGE SYSTEMS; PROVIDING FOR SEVERABILITY; PROVIDING FOR REPEAL OF CONFLICTING ORDINANCES; AND PROVIDING FOR AN EFFECTIVE DATE.

WHEREAS, cities have home rule authority; and

WHEREAS, cities can adopt certain regulations as part of their home rule authority; and

WHEREAS, the City of Groveland has determined that the adoption of a Manual of Standards for the Design, Construction And Maintenance Of Water, Wastewater, Reclaimed Water, Streets And Drainage Systems Is In The Best Interest Of The City.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF GROVELAND, FLORIDA THAT:

<u>SECTION 1</u>: The attached document entitled "City Of Groveland Manual Of Standards For The Design, Construction And Maintenance Of Water, Wastewater, Reclaimed Water, Streets And Drainage Systems" is hereby made part of this ordinance and adopted by reference.

<u>SECTION 2</u>: The Manual of Standards shall apply to all development activity within the City or development to be served by City facilities.

<u>SECTION 3</u>: The Manual of Standards may at time to time be revised or amended by the Public Works Director to improve or maintain the integrity of the City's public works and utilities systems, with the approval of the City Manager, without affecting the validity of this ordinance.

<u>SECTION 4</u>: Severability Clause: Should any provision or section of this ordinance or the Manual of Standards adopted by reference and attached to this ordinance be held by a court of competent jurisdiction to be unconstitutional and invalid, such decision shall not affect the validity of this ordinance or the Manual of Standards as a whole, or any part thereof other than the part so declared to be unconstitutional or invalid.

<u>SECTION 5</u>: All other ordinances or parts of ordinances in conflict with this ordinance or the Manual of Standards adopted by reference be hereby repealed.

<u>SECTION 6</u>: The effective date for implementing this Manual of Standards shall be the date of the adoption of this ordinance.

MANUAL OF STANDARDS

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SECTION 1 GENERAL INFORMATION

1.1 AUTHORITY

1.1.1 Title

This document shall be known as "MANUAL OF STANDARDS FOR THE DESIGN, CONSTRUCTION AND MAINTENANCE OF WATER, WASTEWATER, RECLAIMED WATER, STREETS AND DRAINAGE SYSTEMS," and may be referred to as the "Public Works Manual", as is done hereinafter.

1.1.2 Intent

The intent of this Public Works Manual is to provide for the safe and orderly use and development of the public right-of-ways under the City of Groveland jurisdiction, to the end that the needs and interests of the public are served as fully and efficiently as possible. The regulations embodied herein have been made as broad as possible to serve as standards of quality to maintain the necessary uniformity in the utilization of the public utilities and traffic corridors.

1.1.3 Applicability

These standards are applicable to the design and construction of facilities within the City of Groveland. These specifications, standards, drawings and other information included herein are intended as **MINIMUM** requirements acceptable for projects submitted to the City of Groveland. They apply to all development and construction projects, both public and private, that fall within the jurisdiction of the City. Variances from these standards are not permitted without written approval from the Public Works Director. Applicable Federal, State and local environmental laws and regulations should be considered concurrently with this text.

The provisions of this Public Works Manual do not apply to existing facilities in the public rights-of-way, but <u>do apply</u> to any alteration, extension or maintenance performed upon them from the effective date of these regulations, forward.

1.1.4 Interpretation

The Public Works Director shall make interpretation of all questions concerning the intent of these regulations and may revise these standards without prior notice as deemed necessary to improve or maintain the integrity of the City public works and utilities systems.

1.2 GENERAL

1.2.1 Subdivision Planning

1.2.1.1 Objectives

The objectives of the City of Groveland in subdivision planning are to promote health, safety and welfare in enhancing the quality of life for its residents. This

dictates a safe and efficient access and traffic circulation system. The following principles are to be considered in accomplishing these objectives:

1.2.1.1 Adequate Vehicular and Pedestrian Access

Adequate vehicular and pedestrian access shall be provided for all parcels. Street widths, sidewalk placement, patterns of streets and number of intersections shall take into consideration both safety and efficiency of access to abutting parcels. Every parcel shall abut an approved private street, an approved access easement, or a street dedicated to, and accepted by the City for maintenance.

1.2.1.2 Minimization of Traffic Movements Through Local Streets

Through traffic shall be discouraged through the use of discontinuities in local street patterns by offsetting local street intersections and by channeling or controlling street medians along peripheral major or collector streets. This will reduce the amount and speed of traffic, thereby making local streets more safe and amenable to residents.

1.2.1.3 Logic and Consistency in Street Numbering and Naming

A consistent and logical pattern shall be developed to simplify local street naming and numbering, to assist visitors in locating addresses and facilitate access by emergency vehicles, delivery vehicles, etc.

1.2.1.4 Efficient Traffic Circulation and Development Patterns

Driveways, intersection placement and access shall be controlled so that no parcels require direct access to major or collector streets. Provisions shall be provided for continuing existing principal streets from adjoining areas through new subdivisions. Where streets are extended to subdivision boundaries and abut either undeveloped adjoining land, or connect to collector or arterial roads, the location of the subdivision street shall be coordinated with the Public Works Director to facilitate future street development in adjoining areas, for overall efficiency of traffic flow and for safety considerations of future intersections.

1.2.1.5 Design for Purpose Intended

Local streets shall not be overdesigned or overbuilt (i.e., extra width, higher speed, etc.) to such a degree that will detract from the residential character and which will encourage higher use and higher traffic speed. The use of curvilinear alignment, discontinuities and traffic calming are encouraged to minimize speeds in excess of 30 MPH and discourage through traffic.

1.2.1.6 Minimum of Intersections

Intersections shall be kept to the minimum number practicable, particularly between local streets and collector or arterial roads, to reduce accident potential. Consistent with other requirements, "T" intersections are preferable to four way, or cross type intersections. Streets shall be arranged to intersect

as closely as possible to right angles. In no case shall streets intersect at an angle of less than 75 degrees.

1.2.2 Planning and Design Criteria

1.2.2.1 Local Streets

- 1.2.2.1.1 Maximum length of a cul-de-sac shall be 1200 feet, unless otherwise approved by the Public Works Director. Minimum paved radius shall be 36-feet.
- 1.2.2.1.2Local streets shall intersect with other local streets to the maximum extent practicable, and in no case with more than one collector or arterial road.
- 1.2.2.1.3Loop roads, cul-de-sacs and curvilinear streets shall be considered in the planning and design.

1.2.2.2 Collector Streets

- 1.2.2.2.1 No direct access shall be provided to a collector street from a residential lot.
- 1.2.2.2.2 Collector/arterial streets shall connect to only one collector or arterial road.
- 1.2.2.2.3 Residential dwellings shall face away from collector/arterial streets (i.e., collector/arterial street to side or rear lot line).

1.2.2.3 Commercial Sites

Commercial sites shall conform to these standards in regard to roadway improvements, rights of way, sidewalks, driveways and all other requirements outlined for residential subdivisions, as appropriate.

- 1.2.2.3.1No direct access shall be provided to a collector street from a residential lot.
- 1.2.2.3.2Collector/arterial streets shall connect to only one collector or arterial road.
- 1.2.2.3.3Residential dwellings shall face away from collector/arterial streets (i.e., collector/arterial street to side or rear lot line).

1.2.3 Master Plans

This information on master plans is to be considered only as it pertains to and impacts the design, construction and maintenance of the public works facilities within the jurisdiction of the City of Groveland. Considerations, requirements and conditions of

other agencies having jurisdiction and planning responsibilities may not be reflected in this section.

For residential or commercial developments constructed in multiple phases or for single-phase residential projects with more than one pump station, a Master Plan for water, wastewater and/or reclaimed water is required. Other master plans for streets, stormwater facilities, sidewalks, bicycle paths, etc may be required by conditions of PUD/MPUD approvals.

The Master Plan for utilities must be approved prior to the approval of construction plans. For large subdivisions the Master Plan may require approval before the point of connection can be issued during the processing of the utility service application.

The construction plans must be consistent with the approved Master Plan. For any changes to the development, the Developer must submit a revised and updated Master Plan. The requirement for submittal of a revised master plan may be waived, if the City considers the changes to be minor or not significant.

The Master Plan will consist of a layout of the major water, wastewater, and/or reclaimed water lines superimposed on a topographic map. The layout plan sheet(s) shall be at a minimum scale of 1" = 200' and show existing and proposed improvements in sufficient detail to show intent of design. The master plan shall be signed and sealed by a Professional Engineer licensed in the State of Florida. The requirements for each specific utility plan include the following:

- The topographic map having one-foot contours.
- Developments immediately adjacent to undeveloped tracts shall include a conceptual plan for extension of potable water, wastewater, and/or reclaimed water service to said tracts.
- Master Plans shall have a vicinity map showing the location of the project and the scale used.

Wastewater

- Invert and top elevations for manholes.
- Pipe diameters (both force mains and gravity lines).
- Total wastewater flow (both average daily flow and peak) to each pump station. A summary of each unit or tract stating: Type of use (single family residential, mastermetered residential, commercial, etc.), Unit Flow Factors, and Peaking Factors.
- Pump Station locations with top, invert, and bottom elevations.

Clear delineation of existing versus future units or tracts.

Potable Water

- Calculations for maximum potable water demand based on full or projected ultimate development or use gross acreage and land use. Maximum water demand will be calculated as peak hour flow plus fire flow.
- Consult with the City Public Works Department to obtain a "system response curve" (pressure versus flow) representing the City's water distribution network hydraulic response to the requested water demand.
- Use the network response curve to design the water distribution system. Submit the master plan with a pipe network analysis (e.g., EPANET, KYPIPE, etc.) with flow and pressure distribution for approval. Include connection points and pipe sizes. Available information on hydrant locations and lot platting should be included.

Reclaimed Water

- Calculations for reclaimed water demand shall be developed and submitted only after determination of availability of reclaimed water by the City.
- Consult with the City Public Works department to obtain a "system response curve" representing the City's distribution network response to the requested water demand.
- *Use the network response curve to design a reclaimed water distribution system. Submit the final design with a pipe network hydraulic analysis with flow and pressure distribution for approval. The final design shall include connection points, pipe sizes, meter location(s), and lot platting.

1.2.4 Construction Plans

A) Pre-Submittal Conference

Prior to submittal of Construction Plans, a pre-submittal conference must be held with the City that is attended by the Developer and/or Engineer as applicable.

B) Plans Preparation

The City assumes no responsibility for the design of improvements or for any material specified. Approval of the Plans and Specifications or use of the Minimum Standards does not relieve the Engineer of Record and/or Owner/Developer from his responsibility for providing a complete working system that does not adversely impact the operation of the existing system. While the City will make every effort to ascertain that the plans are in conformance with these standards, the right is reserved to enforce the minimum standards regardless.

It shall be the responsibility of the Engineer of Record to secure proper existing utility information, size facilities and prepare plans all in accordance with these minimum standards. The Public Works Director may, at his option, apply more stringent standards where site specific conditions warrant. Copies of all design criteria and calculations shall be provided to the City.

Referenced standards (AWWA, ANSI, ASTM, NSF, etc.) are the latest revisions thereof. The City assumes no responsibility for standards developed by outside agencies. Note that these standards may not satisfy other agency requirements. Conflicts shall be deferred to the Public Works Director in writing for resolution.

C) Submission

- All construction plans submitted to the City for review and approval shall conform to the requirements of Chapter 471, Florida Statutes and bear the seal and signature of the Florida Registered Professional Engineer responsible for design of the project (Engineer of Record). The address, professional engineer license number and phone number of this individual shall be shown along with the seal and signature.
- 2) Six (6) sets of plans and specifications shall be submitted to the City for approval. Two (2) sets of approved plans will be returned to the Engineer for use in constructing the project. Approval of plans and specifications by the City does not imply approval of any other permits that may be required by other agencies.
- 3) No changes shall be made on approved plans without specific City concurrence. The City will enforce the approved construction plans and specifications to a level equal to that of the minimum standards.
- 4) The City reserves the right to review shop drawings.

B) Format

1) Sheet Size

Construction Drawings submitted to the City for approval shall be in 24" X 36" format. Worksheets and Data shall normally be in 8-1/2" X 11" format (fold-out sheets are permitted).

2) Content

Construction plans shall include appropriate water, sanitary sewers, reclaimed water systems, roadways, stormwater management facilities and all other necessary improvements in accordance with all City specifications, standards and policies. The following list of proposed project information is to be provided as a minimum:

- Area of Each Phase
- 2. Total Area of All Phases
- 3. Area of Wetlands (A)
- 4. Uplands Area (B)
- 5. Area of Conservation Easements for Each Phase
- 6. Total Area of all Conservation Easements
- 7. Current Zoning
- 8. Proposed Use:

Number of Lots

Typical Lot Size

Lot Grading Plan Types

Gross Density

Roadway Dedication

Typical Roadway Construction

Typical Right-of-Way Width

Total Length of Interior Roadways Total

Area of Interior Right-of-Ways (C) Area

of Passive Parks (D)

Total Non-Residential Use (A+C+D)

Net Density

Additional conditions of the approved PUD, if applicable.

9. Proposed Services:

Drinking Water

Sewage Disposal

Fire and Police Protection

Electric

Cable

Telephone

Gas

Schools

Garbage Disposal

10. Minimum Building Setbacks

From Front Property Lines and Right-of-Ways

Front Porch Setback

From Rear Property Lines

From Side Property Lines

Street Side Setback

11. Typical Lot Easements

Front Yard Public Utility

Other

12. Minimum Dimension Requirements

Minimum Roadway Frontage

Minimum Lot Width at Bldg. Setback Line

- 14. Sizes and Lengths of Water Lines
- 15. Number and locations of Hydrants
- 16. Sizes and Lengths of Sewer Lines
- 17. Sizes and Lengths of Reclaimed Water Lines
- 18. All underground utilities in both plan and profile view
- 19. The Florida One Call number for utilities locates shall be shown on the construction plans

1.2.5 Permits

A permit is required for all construction in public right-of-ways under the City of Groveland jurisdiction. Such permits shall only be issued from the Department of Public Works, by authority of the City Manager and City Council. This is not intended to preclude other permits and approvals that may be required by other agencies for other aspects of the work. Except as provided hereinafter, no construction shall be started until a permit for the proposed installation has been granted by the Department of Public Works.

Minor construction or maintenance work, such as installation of water meters (up to 2"), cable splice pits (not in or within two feet of a roadway) street light or traffic signal maintenance, or similar types of work may be done without permit or prior notice to the Department of Public Works. This is not to be construed as including cable replacement or any other type of facility upgrading or rehabilitation involving excavation, except for splice pits as mentioned above.

For work inside of existing manholes within the right-of-way, permission shall be obtained from the Department of Public Works.

None of the above permit procedures shall apply to emergency repair work in public right-of-ways. Emergency repair work is defined, for the purposes of this document, as that which must be done immediately upon discovery, in order to safeguard the public from immediate danger to life or limb, to safeguard public health or welfare or to restore interrupted utility services. In the event of an emergency as defined above, repair work may be started without a permit upon verbal notification being given to the Department of Public Works. If the Department of Public Works offices are closed, then notification must be given as early as possible on the next regular work day. After the emergency repair is completed and the right-of-way is restored, a record drawing must be submitted to the Department of Public Works, unless otherwise provided hereinafter, within ten working days. Work that can be scheduled ahead of time will not be considered emergency work.

1.2.6 Construction

A) Construction Start

1) Notification

The City shall be notified in writing of the proposed construction start date at least two weeks in advance and again forty-eight hours prior to commencing work on any facilities that are intended to be turned over for City ownership, maintenance or operation. Any time work is to stop for a period of time in excess of two (2) working days the City shall be notified in writing of such interruption.

2) Pre-Construction Conference

A Pre-construction conference shall be held at least 1 week prior to the start of construction. The Engineer and/or Developer will be responsible for arranging this conference with the City.

- (a) Insurance certificates must be provided to the City when work involves City property, Right-of-Way, or easements.
- (b) Copies of all required permits must be provided to the City.

3) Approved Plans

A set of plans for the project, bearing the Department of Public Work's approval stamp must be located on the job-site whenever work is in progress. When applicable, a Department of Public Works right of way permit must also be available at the site when work is in progress.

4) Changes to the Plans

All field changes to previously approved construction plans shall be in accordance with these standards and approved by the City prior to implementation. All changes shall be reflected in the record drawings

5) Supervision of Construction

The permittee and/or contractor shall keep sufficient competent supervision on the site while work is in progress to ensure that the work is being performed properly and in a safe and orderly manner.

6) Utility Coordination

The Contractor shall be responsible for contacting the Florida One Call number in timely fashion and for locating and coordinating all utilities located within the project area shown on the Drawings.

5) Connection to Existing Utilities

All taps, tie-ins, etc., to existing facilities shall only be completed within the presence of a City representative. All connections shall be made in accordance with approved plans and specifications as issued by the City.

6) Interruption and Restoration of Services

Adequate provision shall be made for the safe, continuous operation of any utilities, drainage facilities or water courses encountered during construction, unless other approved arrangements have been made.

The operators of all such services and all structures altered or damaged during construction shall be notified immediately, and all such services and structures shall be satisfactorily restored upon completion of work.

7) Job Site Safety

All permitted work in right-of-ways must be done in strict accordance with the provisions of the Occupational Safety and Health Administration (OSHA) regulations, and all other applicable codes.

8) Maintenance of Traffic

When working in public right-of-ways, a maintenance of traffic plan shall be developed in accordance with the following standards:

Florida Department of Transportation Manual of Uniform Minimum Standards for Design, Construction and Maintenance of Streets and Highways. (Green Book).

Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

Florida Department of Transportation Roadway and Traffic Design Standards

US Department of Transportation, Federal Highway Administration, Manual on Uniform Traffic Control Devices for Streets and Highways

Strict adherence shall be maintained throughout the construction period. Temporary measures must be taken, where necessary, to provide a minimum of one lane of traffic in each direction on each affected road at all times, unless specific permission is obtained from the Public Works Director to depart from this requirement. Where such departure is approved, the requesting individual or organization shall notify police, fire and emergency vehicles, the school district and U.S. Mail Service of the location and time of all street closures. Otherwise, access to each home and place of business or assembly abutting the affected right-of-way shall be maintained.

The right-of-way must be maintained in a safe condition, suitable for driving until the permitted work is complete and the right-of-way is restored and accepted for maintenance by the Department of Public Works.

These provisions shall be in effect under all weather conditions, twenty four hours per day, every day, from the commencement of work until final acceptance by the Department of Public Works, except in time of emergency.

9) Underground Facilities

Underground facilities in public right-of-ways, to the extent practicable, shall be installed within a designated area for public utilities adjacent to the right-of- way line. An area of 10-feet width, minimum, shall be reserved for the use of public service utilities or franchisees. Where existing right-of-ways or other limitations render this designated area within the right-of-way insufficient to accommodate all required facilities, a 10-feet easement adjacent to and outside the public right- of-way, shall be dedicated for this purpose. All underground and in-ground facilities in public right-of-ways shall be designed and installed so as to safely sustain any vehicular loads that might be placed upon them.

Prior to placing any underground facility in the public right-of-way, unless otherwise approved by the Department of Public Works, the permittee shall remove all muck and other deleterious material to a point not less than four feet below, and not less than four feet on either side of the facility's intended location. If so doing would endanger an existing facility, contractor shall de-muck only that area which can be done without endangerment. These requirements shall not be mandatory for direct burial cables or conduits for cables.

In all areas to be paved, all underground utility lines not yet in service shall be tested by the permittee or contractor and observed by the City or the Engineer of Record, to determine serviceability and acceptance, after the roadway base has been constructed but before the wearing course(s) have been placed. All damaged or defective portions of such facilities shall be replaced or repaired and re-tested, and the roadway base restored by said maintaining entity. At that point, the facility shall again be tested for serviceability and acceptance. This procedure shall be repeated until the facility is determined to be serviceable and is accepted, after which the wearing course(s) may be placed.

10) Above Ground Facilities

Above ground facilities, where acceptable or approved, shall also be installed within a designated area of 10-feet width, minimum adjacent to the right of way line. Where existing right-of-ways or other limitations render this designated area within the right-of-way insufficient to accommodate all required facilities, a 10-feet easement adjacent to and outside the public right-of-way, shall be dedicated for this purpose.

11) Utilities Crossings Under Existing Pavements

All underground utilities crossings of paved roads shall be made by "jack and bore," "flow moling," or directional drilling, unless an alternate method is approved by the Department of Public Works. Proposed open cuts shall be shown on the drawings submitted for approval. When a pipe or conduit is driven through the earth under pavement, driving shall be done in such a manner as will leave no voids in the underlying earth. Extraction of pipe or conduit from beneath any

roadway, generally, is prohibited. In extreme situations, where pipe must be removed, the roadway must be trenched and later restored in accordance with all applicable provisions of this Public Works Manual.

12) Environmental Protection During Construction

Prior to the start of construction, silt barriers shall be installed to protect wetlands and conservation areas. The Contractor shall check the condition of silt barriers periodically and after each rain event to make sure they are functioning as intended. The Contractor shall remove any downstream siltation prior to the final inspection.

The Contractor shall maintain weekly monitoring reports required by the EPA-NPDES General Permit

13) Completion

a. Record (As-Built) Drawings

The Engineer or Developer shall submit Record Drawings within two weeks following the final inspection.

- b. Certificates of Compliance with the specifications and warranties furnished by material and equipment suppliers shall be submitted to the City on all materials and equipment used in the completion of the work prior to acceptance.
- c. The Engineer of Record shall supply to the City two (2) complete sets of operation and maintenance manuals for all electrical and mechanical components including pumps, motors, control circuits, radios, sensors, meters, wiring diagrams, etc. An O&M manual must be provided for all lift station equipment and installed in the control panel (not part of the 2 sets to be supplied to the City).

1.2.7 Testing

Forty-eight (48) hours minimum notice must be given to the Department of Public Works prior to scheduling any required tests and/or inspections.

The Engineer of Record or his representative shall carefully observe and/or inspect all portions of the permitted installation and conduct the necessary compliance testing to determine that the contractor has substantially complied with all approved plans and specifications related thereto. The Engineer of Record shall so certify to the City of Groveland at the completion of the work.

No labor, material or equipment required for testing of facilities shall be furnished by the Public Works Department, except as noted hereinafter. Tests shall be performed by individuals or organizations qualified and appropriately certified, and shall be performed in the presence of the Engineer of Record, or designated representative, and a Department of Public Works representative. If the Department of Public Works

does not witness a properly scheduled test, after being provided with the required advance notice, the certification of the Engineer of Record will be accepted.

It shall be the Contractor's responsibility to provide the necessary equipment and personnel for all inspections and testing, including televising the sanitary sewer laterals. This shall include all safety equipment necessary to meet OSHA requirements. Inspections shall be scheduled with the City a minimum of 48 hours in advance and will be cancelled if proper testing or safety equipment is not on site and readily available at the time of the inspection.

Access to the work shall be provided by the Contractor for all required tests and inspections. If work is covered up without the City first being provided with the opportunity to inspect or witness such work, the Contractor shall bear all costs associated with uncovering, retesting, additional testing, or any other means necessary to provide physical evidence as to the acceptability of the work performed by the Contractor. Such costs shall be the responsibility of the Contractor regardless of whether or not the work is found to be defective or acceptable to the City.

1.2.8 Inspections

a. Periodic

All projects shall be subject to inspection during and upon completion of construction by an authorized representative of the City. Presence or absence of a City representative during the construction does not relieve the Owner and/or Contractor from adherence to the approved plans and specifications. A representative of the City may periodically visit the project site to make a visual inspection of the progress of the work and methods of construction. Work not in accordance with the plans and specifications will be brought to the attention of the Contractor. The Contractor shall take immediate action to correct the out-of-specification work at his own expense.

Prior to final inspection, the Owner/Contractor shall notify the City in writing that the work has been substantially completed in accordance with approved plans and specifications.

b. Final

Upon receiving a written request for final inspection of the completed work, an authorized representative of the City, together with representatives of other interested agencies, shall perform the final inspection within two weeks of the receipt of the request.

Subsequent to the Engineer of Record certification, signs, pavement markings and signalization will be reviewed and shall be acceptable to the Department of Public Works.

1.2.9 Reports

All reports relating to construction progress, tests or other matters which may be required by the Department of Public Works, other agencies or the Engineer of Record shall be provided to the Department of Public Works without charge.

1.2.10 Final Acceptance

The City will accept ownership of the completed facilities when the work has passed the final inspection and acceptable Record Drawings are submitted to the City. Record Drawings measurements shall be made by a registered land surveyor, licensed by the State of Florida, reviewed by the Contractor and by the Engineer of Record for the project, who shall affix a statement that the information has been reviewed, along with the seal of the Engineer, signature and date on copies of non-reproducible drawings. Record drawings shall show final locations of sewer lines, manholes, valves, fittings, manhole rim and invert elevations, water mains, reclaimed mains, air release valves, bacteriological sampling point locations and all other pertinent information related to the utility system. Service line location and measurement shall be from the next downstream manhole with an indication of the length of service and depth of the end of service. For sewer service lines not located perpendicular to the main, locate the end of the service from two property corners. Record drawings shall also show design and finished grades of site work, and paving, dimensions and elevations of retention/detention areas, weirs and flumes, tops of grates drainage structures, tops and bottoms of skimmers, baffles, etc. inverts and pipe lengths of stormwater pipes and all other information necessary for the Engineer of Record to certify that the project has been constructed in substantial compliance with the design as permitted.

Final acceptance by the City will be made in writing upon satisfactory completion of the project, including final inspection and submittal of the following documents:

- 1. Two (2) Print sets of Record Drawings, signed and sealed by the Engineer of Record
- 2. One (1) compact disc containing the conformed Record Drawings, in AUTOCAD 14 or higher format and ".pdf" format.
- 3. Certifications of Completion from all Regulatory Agencies (i.e. Florida Department of Environmental Protection, St. Johns River Water Management District, Florida Department of Transportation, etc.)
- 4. Recorded easement documents
- 5. Maintenance Bond in the amount of 20% or all contributed assets, with a duration of 2 years. Maintenance Bond shall be accompanied by a letter prepared, signed, sealed and dated by the Engineer of Record documenting the Bond amount.
- 6. Copies of all approved Testing Results (i.e. Pressure Test, Air Test, Lamping, Mandrel, Densities/Compaction, VHS copy of sanitary sewer videotape, etc.)
- 7. Results of Bacteriological Sampling on water lines

Final acceptance by the City will be made in writing upon satisfactory completion of the project, including all items above. The Owner/Contractor shall warranty the work for a period of one year from

the date of final acceptance and shall immediately correct any deficiencies in the work due to materials and/or workmanship, which occur during the warranty period. The date of final acceptance shall be the date on which the Owner/Contractor has fulfilled all conditions necessary for final acceptance.

1.2.11 Maintenance

All items or systems must be designed in such a manner to minimize future maintenance. A two-year maintenance bond on all work shall be furnished to the City at the time of final acceptance, along with all warranties and manufacturers' manuals for all items to be maintained by the City. In addition, all submersible pumps shall be warranted for a period of five years. Warranties shall be extended by six months from the date of any repair to a warranted item. All disturbed earthen areas shall be seeded and mulched or sodded, watered and maintained through the period of first cutting prior to acceptance. The City shall be provided five-year warranties on all pumps, motors, electrical panels, etc. by the manufacturer prior to final acceptance by the City.

1.2.12 Transfer of Private Ownership

When transfer of private facilities to public ownership takes place, all such private facilities shall be brought up to the current City standards at no cost to the City insofar as construction and maintenance are concerned, before the City will accept such facilities. The City is to be furnished copies of all approvals; permits, certificates of completion, etc., to or from completion, etc., to or from other agencies such as Lake County, Florida Department of Environmental Protection, St. Johns River Management District, Florida Department of Transportation, railroads, etc., before proceeding with construction. Proof of satisfactory completion of water and sewer facilities, positive water bacteriological tests, and submission of quit claim deeds, bills of sale, prior and current permits, warranties, manufacturers manuals, and a two year maintenance bond shall be furnished to the City prior to acceptance.

1.2.13 Property Ownership

All facilities within public right-of-way must be owned and maintained by a public service utility or franchisee or by a political entity competent to function within the State of Florida, and shall remain the liability of the last operating entity until removed.

1.2.14 City Ownership, Operation and Maintenance

All facilities to be owned or maintained by the City shall be located on City property, within City right-of-way or on easements dedicated to the City for the uses intended.

The City's responsibility for ownership, operation and maintenance of water mains or water service lines shall end at the meter or backflow prevention device. Hydrant mains and hydrants shall be owned by the City, unless stated otherwise. Fire sprinkler mains shall be owned by the City to the backflow prevention device. Proper easements and testing are required for all City-owned facilities as described below.

The City will not be responsible for maintaining sewer services within private property. The City will not operate, maintain or acquire ownership of any on-site wastewater facility that is not constructed to the City standards. Responsibility for these mains or lift stations will reside with the owner/developer. Ownership and maintenance of all facilities shall be at the discretion of the City.

1.2.15 Approval Period

Plans shall be valid for commencement of construction for a maximum period of one year from the date of City approval only. All items not under construction within one year of the approval date shall require a new approval prior to the commencement of construction.

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SECTION 2 TRENCHING, BACKFILLING AND COMPACTING FOR UTILITIES

2.1 GENERAL

2.2 MATERIALS

2.2.1 Sheeting and Bracing

2.3 WORKMANSHIP

- 2.3.1 Trench Dimensions
- 2.3.2 Utility Bedding
- 2.3.3 Unsuitable Material Below Trench Grade
- 2.3.4 Extra Utility Bedding Material
- 2.3.5 Sheeting and Bracing
- 2.3.6 Excavated Material
- 2.3.7 Material Disposal
- 2.3.8 Borrow
- 2.3.9 Dewatering
- 2.3.10 Existing Utilities and Structures
- 2.3.11 Backfill
- 2.3.12 Roadway and Pavement Restoration
- 2.3.13 Protection and Restoration of Property
- 2.3.14 Cleanup
- 2.3.15 Removal of Pavement, Driveways, Sidewalks, Curbs and Gutters
- 2.3.16 Disposition of Excavated Materials
- 2.3.17 Sheeting, Bracing and Shoring
- 2.3.18 Traffic and Utility Controls
- 2.3.19 Backfill, Embankment and compaction

SECTION 2 TRENCHING, BACKFILLING AND COMPACTING FOR UTILITIES

2.1 GENERAL

The provisions of this section shall be applicable to all underground utility installations including water, sewer, reclaimed water and storm sewer piping, unless prior approval is obtained for alternate methods from the City of Groveland Public Works Director.

The Contractor shall examine the site, review any available geotechnical data and undertake whatever additional subsurface investigations deemed necessary, taking into consideration all conditions that may affect the work including seasonal high water levels. The City will not assume responsibility for variations in subsoil quality or water table.

2.2 MATERIALS

2.2.1 Sheeting and Bracing

- A) No wood sheeting shall be left in place.
- B) Steel sheeting to be left in place shall be as specified in ASTM Designation A328.

2.3 WORKMANSHIP

2.3.1 Trench Dimensions

The allowable width (minimum and maximum) of trenches shall vary according to the outside diameter of the pipe, as indicated on the standard details sheets for differing conditions of construction.

2.3.2 Utility Bedding

- A) Type A (Special Utility Bedding): Special bedding may be required due to depth of cover, impact loadings, or other conditions. Use of Type A bedding shall be determined in the field as directed by the City. Type A bedding methods and materials shall receive prior approval by the City.
- B) Type B (Normal Utility Bedding): The bottom of the trench shall be shaped to provide firm bedding for the pipe. The pipe shall be firmly bedded in undisturbed soil, to a minimum of two feet below the trench bottomhand shaped so that the pipe will be in continuous contact for its full length. Compaction on the sides and over the pipe shall be as shown on the standard details.

2.3.3 Unsuitable Material Below Trench Grade

Soil unsuitable for a proper foundation encountered at or below trench grade, such as muck or other deleterious material, shall be removed for the full width of the trench and to the depth required. Backfilling below trench grade shall be in compliance with the applicable provisions of subsection 2.41 "Backfill".

2.3.4 Extra Utility-Bedding Material

When rock or other non-cushioning material is encountered at trench grade, excavation shall be extended to 6 inches below the outside of the bottom of the utility, and a cushion of sand shall be provided to fully cover the pipe or fittings to a minimum depth of 12".

2.3.5 Sheeting and Bracing

In order to prevent damage to property, injury to persons, erosion, cave-ins, or excessive trench widths, adequate sheeting and bracing shall be provided in accordance with standard practice and in accordance with all safety, protection of property, and other applicable laws and regulations, including the Florida Safe Trench Act.

A temporary trench box shoring system may be used provided it meets the requirements specified herein and in the contract drawings.

2.3.6 Excavated Material

Excavated material to be used for backfill shall be neatly deposited at the sides of the trenches where space is available at a safe distance to minimize collapse of the trench wall. Where stockpiling of excavated material is required, the Contractor shall be responsible for obtaining the sites to be used. No excavated material shall be placed on private property without written permission of the property owner.

2.3.7 Material Disposal

Excess, unsuitable, or cleared or grubbed material resulting from the utility installation shall be removed from the work site and disposed of at locations secured by the Contractor. Excess excavated material shall be spread on the disposal site and graded and grassed in such a manner as to drain properly and not disturb existing drainage conditions, runoff into or siltation of waterways.

2.3.8 Borrow

Should there be insufficient satisfactory material from the excavations to meet the requirements for fill material, borrow materials shall be obtained from pits secured by the Contractor and approved by the City.

2.3.9 Dewatering

Utility piping shall be installed "in the dry" unless otherwise approved. Dewatering systems shall be used in accordance with good standard practice and must be capable of lowering the water level in advance of the excavation and maintain it continuously to keep the trench bottom and sides firm and dry. Any Dewatering equipment to be used in a residential area shall be equipped with a sound attenuating enclosure and approved by the City. The Contractor shall be responsible for obtaining permits and meeting the requirements of applicable regulatory agencies for all dewatering

operations. Groundwater shall be maintained at a level of two feet minimum, below the bottom of all excavations until backfilling is complete.

2.3.10 Existing Utilities and Structures

The Contractor shall be responsible for locating and protecting all existing utilities and structures prior to commencing any construction and shall notify utilities companies sufficiently in advance for them to make the necessary arrangements for field location of existing utilities. Extreme caution shall be exercised when crossing or working alongside existing utilities and structures to avoid damage. In the event existing utilities or structures are damaged, the Contractor shall cooperate, provide all necessary manpower, equipment and materials to assist the utility owner in repairing the damage and restore the service as soon as possible. It shall be the Contractor's further responsibility to coordinate relocation, disruption of service. No utility service shall be disrupted without the prior approval of the utility owner and sufficient advance notice being provided to affected customers.

2.3.11 Backfill

- A) Backfill material shall be clean earth fill composed of sand, or other materials approved by the City. Fill material shall be free from organic matter, muck, marl and rock exceeding 2½ in diameter or other deleterious materials and shall not contain broken concrete, masonry, rubble or other similar materials.
- B) When trenches are cut in pavements or areas to be paved, compaction shall be as indicated in the standard details. In the absence of specified detailed compaction requirements on the standard details, in paved areas compaction shall be as determined by AASHTO Specification T-180, shall be at least 98% of maximum density, for each 12" backfill lift, compaction in other areas shall not be less than 95% of maximum density. Density tests are required for trenches within pavement, across roads and areas adjacent to proposed building structures.

Backfilling of pipe trench under and around structures shall be, for each 12 inch backfill lift, compacted to 98 percent of maximum density as determined by AASHTO Specification T-180.

One compaction test shall be conducted for each 400 linear feet of pipe and for every 100 square feet of backfill under and around structures, and pavement as a minimum.

- C) If, in the opinion of the City, densities are questionable, additional density tests for determination of compliance with the above specified compaction requirements shall be made by a testing laboratory approved by the City at the expense of the Contractor. Test locations will be determined by the City.
- D) If any test results are unsatisfactory, the Contractor shall re-excavate and recompact the backfill at his expense until the desired compaction is obtained.

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- E) Protective concrete slabs ("shock pads") shall be installed over the top of trenches, where required, to protect the installed pipe against excessive loads across roadways and river/swamp areas, as required by the City. The use of these shall be considered only after all other feasible means have been exhausted for obtaining the required depth of cover.
- F) Existing sidewalks and driveways removed, disturbed, or destroyed by construction, shall be replaced or repaired by the Contractor at his expense.
- G) All water, reuse and sewer lines must have a continuous metallic tracing tape placed 18" above them, labeled with the appropriate designation of pipe use, as shown in the standard details.
- All water mains, reclaimed mains and sewage force mains shall have a continuous type TWH PVC insulated copper conductor (#10 solid single strand wire) strapped to the top of pipe at pipe bells and at least four other equally spaced intervals per pipe length and pulled up into all valve boxes and all meter boxes. Locating wires shall be spliced and taped 12 inches back from the splice to insure electrical continuity for the entire length of constructed pressure main. Refer to the details for additional information. A continuity test shall be conducted by the Contractor prior to acceptance by the City.
- I) Piping shall not be backfilled until inspected and approved by the City.
- J) All piping shall be laid with the lettering facing up for identification purposes.
- K) Trenches shall be backfilled, compacted and graded prior to the end of the work day.

2.3.12 Roadway and Pavement Restoration

Open cuts of City streets are not permitted without written approval from the Public Works Director.

- A) Pavement or roadway surfaces cut or damaged shall be replaced by the Contractor to equal or better condition than the original, including stabilization, base course, surface course, curb and gutter, or other appurtenances. The Contractor shall obtain the necessary permits and all applicable authorizations from the proper agencies prior to any roadway work. Additionally, the Contractor shall provide advance notice to the appropriate authority and local emergency services agencies, as required, prior to construction operations.
- B) Restoration shall be in accordance with requirements set forth by the City Public Works Director. The materials of construction and method of installation, along with the proposed restoration design for items not referred to or specified herein, shall receive prior approval from the Public Works Director.
- C) Where existing pavements is removed, the surfacing shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge, with

minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimized.

- D) Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained on a daily basis until final restoration.
- E) Density tests shall be provided for trenches in pavements across roadways as specified in Section 2.41.

2.3.13 Protection and Restoration of Property

During the course of construction, the Contractor shall provide adequate protection to minimize damage to trees, vegetation, surfaced areas, and structures within the construction right-of-way, easement or site, and take full responsibility for repair or replacement of any damage.

Existing trees within the limits of construction that are to remain shall be so noted on the construction plans.

Trenching is not permitted within the root system area of trees that are to remain as shown in the details. If the status of any tree is in question the Contractor shall obtain clarification from a City representative prior to any disturbance of the root system area.

2.3.14 Cleanup

Site cleanup and property restoration shall follow immediately behind construction operations. Cleanup shall be done on an ongoing basis as construction proceeds and normally should be complete at the end of the work day. In addition, the foreman, superintendent or other management representative of the Contractor shall insure that the construction area is "safed up" for the protection of the public prior to the end of each workday and prior to the end of the work week.

2.3.15 Removal of Pavement, Driveways, Sidewalks, Curbs and Gutters

Edges of permanent pavement shall be pre-cut straight, clean and square beyond any damaged base area, including well point locations. Utility cuts in existing pavements shall be restored as indicated elsewhere in these standards. When the removal of sidewalks, curbs or gutters is necessary for construction, they shall be removed in full sections or a minimum of five feet in length, and all broken edges cut smooth by use of a suitable power saw or other appropriate means.

2.3.16 Disposition of Excavated Materials

Broken pavement and other debris shall be removed from the site as soon as practical, unless otherwise directed by the Public Works Department. Excavated materials shall not be stockpiled in the right-of-way during construction without specific approval of the

Public Works Department. All excess materials shall be removed from the work site and disposed of legally by the Contractor at its own expense.

2.3.17 Sheeting, Bracing and Shoring

Sheeting, bracing and shoring shall be used as required to support the sides of the excavation and to prevent any movements which can in any way alter the grade or injure the facility being installed, diminish the width of excavation or otherwise injure or delay the work or endanger personnel, adjacent pavements or other structures. Safety procedures shall be followed and adequate protection shall be furnished to all personnel as required by OSHA and other appropriate health and safety standards. All sheeting or bracing which is not to be left in place shall be cut off at a level of one foot above the top of the installed facility and removed in a manner that will not endanger the work, personnel or adjacent structures.

2.3.18 Traffic and Utility Controls

Excavation for pipe, structures or cable laying operations shall be conducted in a manner that will cause the least interruption to traffic and existing utilities. To the extent possible, fire hydrants, valve boxes, fire and police call boxes and other utility controls shall be left unobstructed and accessible during the construction period. When such obstruction is unavoidable, it must be held to the minimum, and the affected parties given sufficient notice to allow other provisions to be made.

2.3.19 Backfill, Embankment and Compaction

- 2.3.19.1Earth Materials. Earth materials for backfill and embankment shall be clean earth fill comprised of sand, sand and clay, gravel crushed rock or other materials from Groups A-1, A-2 or A-3, AASHTO classification, and shall be free from organic matter and vegetation, debris, large clods of earth or stones, and shall be acceptable to the Department of Public Works.
- 2.3.19.2Flowable Fill. Where approved, or required by, the Public Works Department, ready-mixed flowable fill consisting of portland cement, aggregates, water and mineral admixtures may be used for beddings, encasements for pipes and for backfill applications for trenches, as an alternate to compacted earth fill. Materials and placement shall comply with FDOT Standard Specifications for Road and Bridge Construction, latest edition. Design information and information on materials shall be provided to the Public Works Department.
- 2.3.19.3 Crushed Concrete. Where approved by the Department of Public Works, recycled crushed concrete may be used as an alternate material to granular material for road base in trench crossings. Prior to use, gradation and Proctor Test data shall be submitted and approved by the Engineer of Record and the Department of Public Works. Gradation of crushed concrete materials shall comply with the specifications for granular materials. Gradation analyses shall be taken at intervals determined by the Engineer of Record, and approved by the Department of Public Works, or if changing the source of the material, to evaluate the uniformity of materials. Compaction requirements shall be the same as required for granular materials.

SECTION 3 JACKING AND BORING

3.1 GENERAL

3.2 MATERIALS AND INSTALLATION

- 3.2.1 Dimensions and Material
- 3.2.2 Areas not Under Jurisdiction
- 3.2.3 Workmanship

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SECTION 3 JACKING AND BORING

3.1 GENERAL

- A) The provisions of this section shall be applicable to installation of casing pipe for protection of sewer and water pipelines.
- B) Where directed, underground pipelines crossing existing major City streets, County roadways, Florida State highways, and railroads shall be installed under these trafficways within Jacked and bored steel casing pipe. The Contractor shall obtain in advance and strictly adhere to specific crossing requirements from the authority having jurisdiction.
- C) The Contractor is responsible for submitting the necessary permit documents and obtaining approval from the appropriate authority prior to construction.

3.2 MATERIALS AND INSTALLATION

3.2.1 Dimensions and Materials

Casing pipes under City streets shall be located as shown on the approved construction plans so as to minimize possible conflict with existing or future utilities and structures, with minimum 36 inches depth of cover between the top of the casing pipe and surface of the roadway. Casings shall be new prime steel pipe conforming to the requirements of ASTM Designation A-139, Grade B.

3.2.2 Areas Not Under Jurisdiction

For casing pipe crossings under roadways, railroads, or other installations not within the jurisdiction of the City, the Contractor shall comply with the regulations of the appropriate authority in regard to design, specifications and construction. However, in no case shall the minimum casing pipe diameter and wall thickness, for a specific carrier pipe size be less than that specified in the standard details.

3.2.3 Workmanship

- A) Jacking and Boring operations shall be done simultaneously with continuous installation, until the casing pipe is in final position. Correct line and grade shall be carefully maintained. Add-on sections of casing pipe shall be full-ring butt welded to the preceding length to produce water-tight total pipe strength joints. The casing installation shall produce no upheaval, settlement, cracking, movement or distortion or the existing roadbed or other facilities. Following placement of the carrier pipe within the steel casing, plastic or rubber boots are to be installed to close each open end.
- B) Casing pipe holes shall be mechanically bored through the soil by a cutting head on a continuous auger mounted inside the pipe. The auger shall extend a minimum distance beyond the end of the pipe casing to preclude formation of voids outside of the pipe shell.

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- C) The casing pipe shall be adequately protected to prevent crushing or other damage under jacking pressure.
- D) Jacking and Boring Pits shall be excavated and maintained to the minimum dimension. Excavations shall be adequately barricaded, sheeted, braced and dewatered as required. The edge of the jacking pit shall be a minimum of 6 feet from the edge of pavement. The Contractor shall follow the requirements of OSHA and the Florida Trench Safety Act.
- E) The carrier pipe shall be either Pressure Class 350 ductile iron pipe, or with prior City approval, SR14 or DR18 PVC pipe, with restrained joints. The carrier pipes shall be supported by pre-manufactured stainless steel casing spacers within the casing pipe.

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SECTION 4 DIRECTIONAL DRILLING

4.1 **GENERAL**

- 4.1.1 Submittals
- 4.1.2 Requirements

4.2 **MATERIALS**

- 4.2.1 Material Specs4.2.2 Transition Couplings

4.3 **INSTALLATION REQUIREMENTS**

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SECTION 4 DIRECTIONAL DRILLING

4.1 GENERAL

The section covers the work, including all labor, machinery, construction equipment and materials required for providing horizontal directional drills where indicated on the Drawings. Directionally drilled piping shall be installed to the lines and grades indicated on the Drawings. Care shall be taken to prevent damage to the surrounding area and to private property.

4.1.1 Submittals

The Contractor shall submit to the City of Groveland, a directional drilling plan as a shop drawing submittal, which shows any areas proposed to be directionally drilled other than those shown on the Drawings.

4.1.2 Requirements

- A) All horizontal directional drilling materials and methods shall meet the requirements of the current Section 555 Horizontal Bore of the FDOT Standard Specifications. Materials shall be in accordance with ASTM D2447, ASTM D3350, ASTM F714 and ASTM D2513.
- B) The method and equipment used in directional drilling operations shall be of adequate commercial size and in satisfactory working condition for safe operations, and may be subject to approval by the City at the discretion of a representative of the Public Works Director (City designee). Such approval, however, shall in no way relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein. Only workmen experienced in equipment operations shall be used in performing the work. It shall be understood that when a change in construction method or any increase in limits as specified herein is requested by the Contractor and authorized by the City, payment for the work will be based on the Contract price originally bid.
- C) The Contractor and the City designee shall walk the project site prior to construction to determine if any specific areas may be more conductive to directional drilling in lieu of open cutting in order to minimize surface disturbances. With the City's approval, certain areas (e.g., cul-de-sacs and areas with established landscaping) may have pipelines installed by the directional drilling method provided all other requirements stipulated are satisfies.
- D) If the Contractor determines it is to its advantage to extend directional drills for longer distances than called out for on the Drawings, such as for crossing multiple driveways, etc., with a single bore in lieu of trenching between bores as indicated, payment for the additional length will be made on the basis of the unit cost per foot for the type of pipe and installation (trenching) shown on the Drawings for the segment.

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4.2 MATERIALS:

4.2.1 Materials Specs.

Unless otherwise shown on the Drawings or provided elsewhere in these Specifications, directionally drilled pipe shall be construction of High Density Polyethylene (HDPE), minimum SDR 11, having a pressure rating of 160 psi. HDPE used for potable water mains shall comply with AWWA Standard C906 and be approved by the National Sanitation Foundation (NSF) for potable water use. A continuous blue stripe shall be provided on two sides. HDPE used for sanitary sewers shall be provided with a continuous green stripe on two sides. HDPE used for reclaimed water shall have a continuous purple stripe on two sides.

4.2.2 Transition Couplings

Transition couplings shall be provided for HDPE pipe to ductile iron mechanical joint fillings, integrally restrained for a minimum design pressure of 160 psi.

4.3 INSTALLATION REQUIREMENTS

- 4.3.1 Directional drilling operations shall be performed by individuals certified by the manufacturer as experienced operators.
- 4.3.2 The directional drilling system shall produce a small diameter tunnel providing a minimum cover of 36" over the installed pipe.
- 4.3.3 HDPE piping shall be field cut, with no joints under water body crossings or other areas having limited future accessibility. If joints are required elsewhere, fusion seams shall be butt weld joints.
- 4.3.4 Fusion Seams on HDPE directionally drilled pipe shall be pressure leakage tested above grade prior to in ground placement, at a minimum hydrostatic test pressure of 150 psi.
- 4.3.5. HDPE piping shall have a Type TWH insulated PVC copper conductor, #10 solid strand wire taped to the pipe at equally spaced intervals at a maximum of four feet
- 4.3.6 Directional drilling operations shall be done with continuous installation, at a smooth constant speed, until the directional drilling pipe is in final position. Correct line and grade shall be carefully maintained. After successful installation of the carrier pipe, the CONTRACTOR shall immediately remove all soil and debris, which may have collected in the carrier pipe during installation and dispose of properly. Flushing and pigging shall be required to clean the pipe.
- 4.3.7 At no time during the installation shall the tension stress on pull back, as calculated by pull-nose strain versus time interval of pull, exceed 90% of the total yield force of the pipe being pulled.

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- 4.3.8 The pull-nose shall be pulled a minimum of 4% extra length and allowed to stand overnight to allow for stretch recovery and thermal contraction to an equilibrium temperature.
- 4.3.9 HDPE pipe installation shall produce no upheaval, settlement, cracking, movement or distortion of the existing surface or utilities. Following placement of the HDPE pipe, HDPE to Ductile Iron MH Transition fittings are to be installed on each end.
- 4.3.10 Only drilling fluids and lubricants having no potential adverse environmental effects shall be used. All drilling fluids shall be directed away from water bodies and comply with the requirements of USCOE, FDEP and the water management district having jurisdiction over the area of the Project. Drilling fluids from the borehole shall be contained and removed from the site upon completion of the bore.
- 4.3.11 The HDPE directional drilling pipe shall be adequately protected to prevent crushing or other damage.
- 4.3.12 Pits for directional drilling shall be excavated and maintained to the minimum dimension. Said excavations shall be adequately barricaded, sheeted, braced and dewatered, as required elsewhere in these specifications. The Contractor shall follow the requirements of OSHA and the Florida Trench Safety Act.
- 4.3.13 The Contractor shall be fully responsible for all directional drilling installed. The Contractor at its expense shall repair any noticeable surface defects resulting from improper operation of this drilling equipment.

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SECTION 5 PIPE, FITTINGS, VALVES, AND APPURTENANCES

5.1 GENERAL

5.2 PIPE AND FITTINGS

- 5.2.1 General
- 5.2.2 Ductile Iron
- 5.2.3 Polyvinyl Chloride (PVC)
- 5.2.4 High Density Polyethylene (HDPE) Pipe and Tubing
- 5.2.5 Polyethylene Plastic Tubing
- 5.2.6 Copper Pipe and Tubing
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5.3 VALVES

- 5.3.1 General
- 5.3.2 Backflow Devices
- 5.3.3 Check Valves
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- 5.3.5 Butterfly Valves
- 5.3.6 Valve Boxes
- 5.3.7 Meter Boxes
- 5.3.8 Fire Hydrants
- 5.3.9 Service Lines
- 5.3.10 Water Meters

5.4 INSTALLATION

5.4.1 General Requirements

SECTION 5 PIPE, FITTINGS, VALVES, AND APPURTENANCES

5.1 GENERAL

- A) This section includes the material and installation standards for pipe, fittings, valves, and appurtenances, used in water, sewer and reclaim installations.
- B) Required specialty items not included under this Section shall be high quality and consistent with approved standards of the industry for the applicable service installation, and shall be approved by the City of Groveland prior to installation.
- C) All material is to be furnished by the Contractor or Developer, with the exception of meters and meter couplings.
- D) All water, reclaimed water, and sewer system components shall be flood proofed against the 100 year flood occurrence and against inflow and infiltration.

5.2 PIPE AND FITTINGS

5.2.1 General

All pipe and fittings shall be clearly marked with the name or trademark of the manufacturer. All pipe and fittings shall be suitable for 150 psi. working pressure and shall meet all applicable AWWA specifications. All pipe installations shall have indicator or locator tape run with pipe to indicate the purpose of piping (water, sewer, force main, reclaimed water, etc.) and copper tracing wire for location purposes on all non-ferrous pipe.

Pipe smaller than 4," except for service lines, shall not be used in City utilities systems unless otherwise specifically approved by the City.

5.2.2 Ductile Iron

- A) Ductile iron pipe shall be in accordance with ANSI/AWWA C151/A21.51. Pipe shall be laid in accordance with ANSI/AWWA C150/A21.50. Thickness class shall be governed by design conditions, minimum pressure class shall be350.
- B) Cast and ductile iron fittings shall conform to ANSI/AWWA C110-A21.10 and ANSI/AWWA C153/A21.53. All underground fittings shall be mechanical joint, unless otherwise specified.

C) Joints

- 1) "Push-On" and mechanical type joints shall be in accordance with ANSI/AWWA C111/A21.11.
- Restrained joint assemblies with mechanical joint pipe shall be Mechanical Joint Retainer Glands, "locked-type" joints of EBAA Megalug Series 1100 or approved equal.

- 3) Flanged connections shall be in accordance with ANSI/AWWA C115/A21.15, 125 lb. standard.
- 4) No leaded joints or connection of any kind will be permitted.
- 5) PVC fittings for pressure mains are prohibited for pipe larger than 2 inches in diameter, unless otherwise specifically approved by the City.

D) Coatings and Linings

- 1) Ductile iron pipe and fittings for force mains or when used as gravity sewer service shall receive an interior epoxy lining for both pipe and fittings in accordance with AWWA C210.
- 2) Ductile iron pipe and fittings for water and reclaimed service shall be cement mortar lined in accordance with ANSI/AWWA C104/A21.4.
- 3) Ductile iron pipe and fittings for water, sewer and reclaimed water shall receive an exterior asphaltic coating approximately 1 mil thick. The coating shall be applied to the exterior of all pipe and fittings unless otherwise specified. Coatings shall be applied in accordance with AWWA C110 & C153-fittings, AWWA C115-flanged pipe, and AWWA C151-ductile iron pipe.

5.2.3 Polyvinyl Chloride (PVC)

A) Pipe shall be manufactured from clean virgin Type I, Grade I rigid, unplasticized polyvinyl chloride resin (Class 12454-A or Class 12454-B) conforming to ASTM D1784. The PVC compound shall have an established hydrostatic design basis (HDB) of 4000 psi as described in ASTM D2837. The pipe shall bear the National Sanitation Foundation (NSF) seal for potable water pipe. Pipe with diameters less than 4" shall be Class 200 with a minimum Standard Dimension Ratio (SDR) of 21 and shall be in accordance with ASTM D-2241.

Pipe with diameters of 4" to 12" for water mains shall have a minimum dimension ratio (DR) of 18, Class 150, and shall be manufactured in accordance with AWWA Specifications C-900 latest revision. Pipe with diameters of 14" and larger for water mains shall have a minimum dimension ratio (DR) of 25, Class 165, and shall be manufactured in accordance with AWWA Specification C-905 latest revision. Pressure Class 350 ductile iron pipe (per Section 4.22) may also be used. Pipe with diameters of 4" to 12" for sewer force mains shall have a minimum dimension ratio (DR) of 25, Class 100, and shall be manufactured in accordance with AWWA Specification C-900 latest revision. Pipe with diameters of 14" and larger for sewer force mains shall have a minimum dimension ratio (DR) 25, Class 165, and shall be manufactured in accordance with AWWA Specification C-905 latest revision. Pressure Class 350 ductile iron pipe (per Section 4.22 may also be used.) Sanitary gravity sewer pipe shall have a minimum standard dimensional ratio (SDR) of 35, for installations up to 13 feet in depth, and shall be manufactured in accordance with ASTM D3034. Sanitary gravity sewer pipe shall have a

minimum standard dimensional ratio (SDR) of 26 for installations deeper than 13".

PVC Pipe Restrainers shall be EBAA Megalug Series 2000, or approved equal.

PVC PIPE COLORS

WATER - Blue

SEWER - Green (Force main); Green (Gravity Sewer)

RECLAIMED - Pantene Purple

- B) Connections and fittings for pipe 1½" and smaller shall be solvent welded sleeve type joint. Connections and fittings for pipe 2" and 2½" in diameter shall be rubber compression ring type. Pipe shall be extruded with integral thickened wall bells without increase in DR. Rubber ring gaskets shall consist of synthetic compounds meeting the requirements of ASTM Designation D1869, and suitable for designated service. Fittings for Pressure mains 3" and larger (water lines or, sewage force mains) shall be ductile iron with mechanical joint rubber compression ring type joints.
- C) All piping (PVC, Polyethylene tubing) shall have a Type TWH insulated PVC copper conductor, #10 solid strand wire that is taped to the pipe at pipe bells and at least four other equally spaced intervals per pipe length.
- 5.2.4 High Density Polyethylene (HDPE) Pipe and Tubing

Pipe and tubing shall comply with AWWA C906, AWWA C800 and AWWA C901, and be certified for potable water service by the National Sanitation Foundation.

A) Materials

1) Pipe and Fittings:

The pipe supplied under this specification shall be high performance, high molecular weight, high density polyethylene pipe, PE 3408. The pipe shall conform to ASTM D 1248 (Type III C, Class C Category 6\5, P.O. 3408). Minimum cell classification values shall be 345434C as referenced in ASTM D 3350 – latest edition. The fittings supplied in this specification shall be molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe. Fitting connections shall be made with flange adaptors using 316 stainless steel back up rings and 316 stainless steel hardware. A separate ½" Schedule 40 PVC conduit shall be installed on the top side of the HDPE directional bore containing 14 Gauge tracing wire. All HDPE directional bores larger than 2" in diameter shall have fusion welded fittings and ends for connection.

2) Tubing and Fittings:

The tubing supplied under this specification shall be high performance, high molecular weight, high density polyethylene tubing, PE 3408. The

pipe shall conform to ASTM D 1248 (Type III, Grade P34, Class A Category 5). Minimum cell classification values shall be 345434E as referenced in ASTM D 3350 – latest edition. The tubing shall be as manufactured by Endot Industries or a Florida Department of Environmental Protection approved equal. The fittings shall be brass, equipped with compression type connections.

3) Quality Control:

- a) The pipe and tubing shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects, and shall be identical in color, density melt index, and other physical properties.

 The City may request certification that the pipe produced is represented by the quality assurance data. Additionally, test results from manufacturer's testing which shows the pipe does not meet appropriate ASTM standards or manufacturer's representation, can be cause for rejection. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM, D 3350, 10.1.9.
- b) The City may request certified lab data from the manufacturer to verify the physical properties of the materials supplied under this specification or may take random samples for testing by an independent laboratory.
- c) Polyethylene pipe, tubing and fittings any be rejected for failure to meet any of the requirements of these specifications.

4) Material Dimensions:

a) Pipe for sizes 4" and larger supplied under this specification shall have a nominal IPS (iron pipe size) O.D. and shall be rated for a minimum working pressure of 160 psi with a minimum Standard Dimension Ratio (SDR) of 11 for force and water main pipes.

5) Construction Practices:

a) Trench Construction

The trench and trench bottom shall be constructed in accordance with ASTM Standard D 2321-Section 7.

b) Embedment Material"

Embedment materials shall be Class I, Class II, or Class III materials as defined by ASTM D 2321-Section 6. The use of Class IV and Class V materials for embedment is not

recommended and shall be done only with the approval of the City of Groveland.

c) Bedding:

Bedding of the pipe shall be performed in accordance with ASTM Standard 2321-Section 8. Compaction rates shall be as specified in ASTM D 2321. Deviations from the specified compaction must have the approval of the City.

d) Haunching and Initial Backfill:

Haunching and initial backfill should be as specified in ASTM D 2321-Section 9 using Class I, Class II, or Class III materials. Materials used and compaction rates shall be as specified by the engineer. In cases where a compaction rate of 95% Standard Proctor Density is not attainable, the Engineer may wish to increase the SDR of the pipe to provide adequate stiffness.

e) Special Conditions:

ASTM D 2321-Section 11.2, minimum cover for load applications, section 11.44, removal of trench protection should apply unless directed otherwise by the City.

f) After polyethylene piping is installed and backfilled, the contractor shall apply an initial hydrostatic pressure to the pressure listed in the piping schedule shown on the drawings. The initial test pressure shall be allowed to stand without makeup pressure for a period of time as required by the pipe manufacturer and approved by the City to allow for diameter expansion or pipe stretching to stabilize. After the required equilibrium period the test section shall be returned to the original test pressure.

g) HDPE Pressure testing Procedures:

The initial pressure test can be conducted before the line is backfilled. However, it is advisable to cover the pipe at intervals or particularly at curves to hold the pipe in place during pressure test. Flanged connections may be left exposed for visual leak inspection. The main shall be tested after the final installation is completed.

Test pressure should not exceed 1.5 times the rated operation pressure of the pipe or the lowest rated component in the system.

The initial pressure test shall be applied and allowed to stand without make up pressure for a sufficient time to allow for diametric expansion or for the pipe stretching to stabilize. This usually occurs within 2 to 3 hours. After this equilibrium period,

the test section can be returned to the 1.5 times operating pressure, the pump turned off, and a final test pressure held for 2 hours.

Allowable amounts of make up water for expansion during pressure test is shown in Chart 6, PPI technical report TR 31/9-79. There shall be no visual leaks or pressure drips greater than 5 psi. during the final test period.

Under no circumstances shall the total time under test exceed 3 hours at 1½ times the pressure rating. If the test is not completed because of leakage, equipment failure, or other reason, the test section shall be permitted to 'relax' for 8 hours before the next testing sequence.

5.2.5 Polyethylene Plastic Tubing – 2" and Less

Tubing shall comply with AWWA C800 and AWWA C901, be approved for potable water service by the National Sanitation Foundation and bear the NSF seal. Tubing shall be Endot "Endopure" CTS OD tubing, or Driscolite PE 3408, SDR9, 200 psi, Type III, Grade P-34, Class C, blue in color for potable water. The product shall be rated for a minimum working pressure of 200 psi with a minimum Standard Dimension Ratio (SDR) of 9. Fittings shall be brass, equipped with compression type connections.

5.2.6 Copper Pipe and Tubing

Pipe or tubing shall meet AWWA C-800. Fittings shall be brass, with approved compression connections.

5.2.7 Special Items

A) Any tap or valve installation into the existing City system shall be made by the City or approved agent at the expense of the Developer. The cost for taps shall be set by the City of Groveland Water Department at current prices at the time of the tap.

B) Service Saddles

Shall be Ford #F202 Series, double strap with IP outlet, or City approved equal. Sealing gasket shall be BUNA-N rubber and straps shall be steel.

5.3 VALVES

5.3.1 General

The valves type, size, rating, flow direction arrow if applicable, and manufacturer shall be clearly marked on each unit. Valves shall open left (counterclockwise) with an arrow cast in the metal of operation hand wheels and nuts indicating the direction of opening. Valves shall be located on each leg of every tee and cross.

A) Valves for Underground Service

Valves from 2" thru 12" for underground service shall be iron body gate valves, non-rising stem type and shall be equipped with a 2" square cast iron operating nut with corrosion protection coating inside and out. Resilient seated valve which meets all C-509 requirements of AWWA (water). Acceptable manufacturers are Mueller A2370-20, American Darling CRS-80 or equivalent Kennedy or Clow models. All dead end lines shall have valves at the end equal to the size of main line with blow off attached. End line valves shall be adequately restrained to the pipeline such that they may be excavated and the line extended without shutting off line pressure.

Tapping valves shall be resilient seat gate valves as manufactured by either Mueller or American.

B) Valves for Above-Ground Service for Water Systems Only

Valves shall be flanged iron body, bronze mounted resilient seat gate valves, conforming to AWWA C-509, with the exception that valves shall be outside screw and yoke (OS & Y) rising stem type. Valves shall have cast iron hand wheels or chain operators with galvanized steel chains, as required. Valves for fire suppression system shall be approved by City fire officials and a detector valves may be required.

C) Valves Smaller than 2 Inches

Valves smaller than 2 inches shall be bronze body gate valve conforming to Federal specifications 150 psi minimum working pressure with threaded joints equal to American 3 FG or City approved equal.

5.3.2 Backflow Devices

- A) All services are to be protected by a backflow prevention device suited to the highest degree of hazard encountered at the connection. Maintenance of the device is to remain the responsibility of the Utility Customer, including proper certifications.
- B) Double check valves assembly shall be designed to specification of the USC Cross Connection Control Laboratory, and A.S.S.E. #1015.

Double check valves shall be Febco 805-Y-BV for 3/4" thru 2" and Febco 805-YD for 2 1/2" thru 10", Watts #709 Series 3/4" thru 10". Double check valve assembly from 2 1/2" and up shall be furnished with OS & Y gate valve shut-offs.

- C) All commercial services shall be equipped with backflow prevention devices that are in compliance with the City of Groveland Backflow Prevention Code.
- D) Pressure vacuum breaker shall be designed to specification of USC Cross Connection Control Laboratory, A.S.S.E. #1020. Spring loaded single float and disc with independent water inlet and air inlet valves. Furnished with shut-off valves and ball type test cocks. Pressure vacuum breaker shall be Watts #800 or Febco #765.

- E) Shut-off valves on backflow assembly for sizes ¾ inch through 2 inches shall be provided with ball valves, assemblies above 2 inch shall be provided with resilient seat full flow gate valves.
- F) Where reclaim water is available, all potable water connections shall be equipped with a reduced pressure zone backflow prevention device.
- G) All backflow prevention devices shall be set within 12" of the meter and shall be set a minimum of 12" above the 100 year flood plain.
- H) Fire sprinkler systems to have a Double detector check valve assembly (D.D.C.).

5.3.3 Check Valves

Valves for wastewater application shall be iron body, bronze mounted stainless steel hinge pin, outside lever and spring operated, swing type, and equipped with removable inspection covers. Units shall be rated for 150 psi minimum working pressure and shall permit full flow area equal to that of the connecting pipe. Mueller #2600-6-02, American Darling #52SC, or Kennedy or M & H equivalents.

5.3.4 Plug Valves

Valves for wastewater application shall be epoxy lines, semi-steel body, non-lubricated, eccentric type plug valves, with resilient faced plugs, and capable of drip-tight shut-off at the rated pressure if applied at either port. Operation of all valves 8" or larger and smaller sizes in exposed locations which require hand wheels or chain wheels, shall be by approved gear actuators, equipped with position indicator and stop, and shall be furnished by the valve manufacturer. Gear actuators for buried or submerged installations shall be furnished with sealed enclosures. Valves shall be equipped with actuating nuts, cast iron hand wheels or chain operators, with galvanized steel chains, as appropriate for the installation and type of operator. Valves and appurtenances shall be Series 100, as manufactured by DeZurik Corp., Clow or approved equal.

5.3.5 Butterfly Valves

Valves larger than 12" shall be cast iron body, self-lubricated, resilient seated, one-piece stainless steel shaft, and capable of drip-tight shut-ff at the rated pressure and meet AWWA C504. Valve operators shall conform to AWWA C504. Valve operator for buried or submerged installations shall be furnished with sealed enclosures. Valves shall be equipped with actuating nuts, cast iron hand wheels or chain operator as appropriate for the installation and type of operator. Valves shall be installed in a vertical position. Valves and appurtenances shall be DeZurik Series 130, American-Darling 150 or Pratt. All valves shall be accompanied by a 3-inch diameter bronze valve marker anchored in the concrete pad which indicates size of valve, type of valve, service (water, sewer, etc...) and direction and number of turns to open.

5.3.6 Valve Boxes

Units shall be adjustable, cast iron, minimum interior diameter of 5", with covers cast with the applicable inscription in legible lettering on the top; "SEWER", "RECLAIMED" or "WATER". Boxes shall be suitable for the applicable surface loading and valve size. Valve boxes not in the pavement shall have concrete pads, around their tops, which will be flush with the top of the curb, with minimum dimensions of 24"x 24"x 4" and reinforcement as shown in the standard details. Valve boxes located in the pavement shall have concrete pads around their tops, which will be flush with the top of the pavement, with minimum dimensions of 24"x 24"x 6" and reinforcement as shown in the standard details. All valves shall be accompanied by a 3" diameter bronze valve marker anchored in the concrete pad which indicates size of valve, type of valve, service (Water, Reclaimed, Sewer) and direction and number of turns to open.

5.3.7 Meter Boxes

Plastic meter boxes shall be Brooks Catalog #1419 with overlap lid, plastic with metal meter reader, or approved equal.

5.3.8 Fire Hydrants

- A) Fire hydrants shall be of Mueller Super Centurian 200 oil reservoir, American Darling 6" B-84-B, 5-1/4" Clow Medallion UL/FM, or Kennedy KD1-D.
- B) A blue roadway reflector shall be required to be installed in the center of the travel lane next to each fire hydrant.

5.3.9 Service Lines

Service lines shall be 1" for single and 1-1/2" with 1" branch off for double service. All fittings shall be Mueller, McDonald or Ford brass. One inch (1") corporation stops shall be Ford FB1100, McDonald 4704B-22, or Mueller 25028. Two inch (2") corporation stops shall be (MIP x MIP) Ford FB500 or McDonald 3131B. Curb Stops (lock wing), shall be in accordance with the table below:

Size	Туре	Ford	McDonald	Mueller
3/4"	FIP x FIP	B11-233W	6101W	B20200 R
3/4"	Comp x FIP	B41-233W	6102W-22	B225170 R
3/4"	FIP x SPUD	B13-232W	6101MW	B24351 R
3/4"	Comp x SPUD	BR43-232W	6100MW-22	B24350 R
1"	FIP x FIP	B11-344W	6101W	B20200 R
1"	Comp x FIP	B41-344W	6102W-22	B25170 R
1"	FIP x SPUD	B13-344W	6101MW	B24351 R
1"	Comp x SPUD	B43-344W	6100MW-22	B24350 R

Note: Service layout must be approved by the City.

5.3.10 Water Meters

All meters shall be supplied by the City at the expense of the utility customer, up to 2". All meters larger than 2" shall be purchased by the City billed to the utility customer.

5.4 INSTALLATION

5.4.1 General Requirements

- A) Piping, fittings, valves and appurtenances shall be installed in accordance with these Standard Specifications and/or approved by the City of Groveland.
- B) Piping shall be installed along straight line and grade between fittings, manholes, or other defined points, unless definite lines of alignment, deflection or grade change have been established. Modification to approved alignment or grade during construction shall receive prior approval from the City and all resulting design considerations shall be resolved by the Contractor.
- C) Materials shall be cleared and maintained clean, with all coatings protected from damage. The interior of the pipe shall be free of dirt and debris, and when work is not in progress, all open ends shall be plugged.
- D) Pipe, valves, fittings, or other items shall be inspected prior to installation, and any items showing a fracture or other defect shall be rejected. However, ductile iron pipe showing an end crack, with no fracture indicated beyond that visible may be salvaged by cutting off the damaged section 12" past the crack, providing the remaining pipe is sound.
- E) Underground piping shall not be driven to grade by striking it with an unyielding object. When the pipe has been properly bedded, enough compacted backfill shall be placed to hold the pipe in correct alignment. If necessary, precaution should be taken to prevent flotation.
- F) Joining pipe shall be by an approved method and shall not require undue force to accomplish full satisfactory seating and assembly. Connections at structures shall be cut accurately and worked into place without forcing and shall align with the connecting point.
- G) "Mega-Lug" restrained joints shall be provided at all bends, wyes, tees, caps, valves, hydrants and reducers. If any joints are within the required restrained length they shall be restrained with a restraining harness as required. The restraints will be sized and placed according to the construction plans or according to the pipe manufacturer's recommendations when not shown on the plans, and approved by the City.
- H) Subaqueous pipe laying may be permitted where conditions make it impractical to lay pipe in the "dry", provided the contractor submits his plans for laying pipe under water to the City and obtains advance approval thereof.
- I) Ductile iron pipe is required at all street crossings, ditch crossings, culvert crossings, jack and bore crossings, or stormwater or sewer crossings and other

situations when a minimum depth of cover, as determined by the City, cannot, be attained, with the exception of directional bores, which shall be minimum SDR-11 HDPE.

- J) Ductile Iron Pipe installation shall be performed in accordance with applicable provisions of the latest AWWA Specifications.
- K) Polyvinyl Chloride (PVC) pipe-lubrication and/or solvent for pipe and fitting Joints shall be non-toxic (NSF approved for potable water). Following making, solvent type joints shall not be disturbed for 5 minutes and shall not have internal pressure applied for 24 hours, or as recommended by the pipe manufacturer.
- L) All pipes, 8" and larger shall be cleaned by "Pigging" prior to disinfection.
- M) Disinfecting of all potable water pipes shall be accomplished by the Contractor following approved pressure testing. Unless alternate procedures are set forth under the applicable service standard, disinfecting procedures shall be in accordance with AWWA Standard C651.

SECTION 6 POTABLE WATER SYSTEM REQUIREMENTS

6.1 GENERAL

6.2 DESIGN

- 6.2.1 Demand Calculations
- 6.2.2 Design Standards
- 6.2.3 System Fire Flows
- 6.2.4 System Size Computations
- 6.2.5 Valve Locations
- 6.2.6 Pipe Separation

6.3 INSTALLATION

- 6.3.1 General
- 6.3.2 Fire Hydrants
- 6.3.3 Joint Restraining
- 6.3.4 Pipe Depth and Protection
- 6.3.5 Connections at Structure
- 6.3.6 Special Exterior Protection for Corrosion
- 6.3.7 Air Venting and Blow Offs
- 6.3.8 Service Connections

6.4 TESTING

6.5 DISINFECTING

SECTION 6 POTABLE WATER SYSTEM REQUIREMENTS

6.1 GENERAL

This section sets forth the general requirements of the City of Groveland for design and installation and testing of water distribution systems for potable water service.

6.2 DESIGN

6.2.1 Demand Calculations

Normal flow demands for design shall be calculated on the basis of full ultimate development as known, or projected. The average daily flow for domestic use shall be calculated at the minimum rate of 315 gallons per day per equivalent residential unit, with 3.5 persons per single family residence, and 2.5 persons per multi-family or mobile home dwelling unit. Maximum day instantaneous demand to be used for design shall be 1.0 gallons per minute (GPM) per single family residence and 0.7 GPM per dwelling unit for each multi-family or mobile home unit. Flow demands for commercial, industrial or other special developments shall be established from existing records or by estimated projections, using the best available data. It shall be stated in the Developers Agreement that the Developer shall bear sole responsibility for sizing the water system improvements to meet the projected demand for the Development. Any future onsite upsizing of utilities required due to more intensive uses of the land shall be the responsibility of the Developer.

6.2.2 Design Standards

Water main installations shall generally be in accordance with the Great Lakes Upper Mississippi River Board of State Public Health & Environmental Managers, "Recommended Standards for Water Works," Latest Edition" (Ten States Standards).

The American Water Works Association (AWWA) Standards shall be adhered to in all aspects of the design, as well as for construction, testing and operation of all potable water systems

6.2.3 System Fire Flows

Water distribution systems and/or water main extensions shall be designed and constructed in accordance with the fire protection requirements of the Insurance Services Office (National Board of Fire Underwriters), as stated in their publication "Guide for the Determination of Required Fire Flows", if not conflict with the following:

- A) Fire flows in single family residential areas shall provide a minimum of 500 GPM at a 20 psi residual pressure at peak flow.
- B) Fire flows in commercial, institutional, industrial areas and apartment or multiunit complexes, shall provide a minimum of 1500 GPM at a 20 psi residual pressure. Larger commercial/industrial, major shopping centers, schools, and

similar uses shall have a fire flow capacity of 2500 to 3500 GPM or as determined necessary by the Fire Marshall.

C) Fire Hydrants

Distance from or spacing of fire hydrants shall be as shown below, measured from the furthermost point of any structure, as the Fire Department would lay hose, or as otherwise specified by the Fire Marshall to meet determined water flow requirements for fire protection and/or increase fire protection effectiveness. Fire hydrants shall be connected to water mains of 6 inch minimum size which are of satisfactory loop design in low density residential subdivisions and a minimum of 8 inch mains in all other areas. Connections to dead end stubs are acceptable, provide that said stubbed water main is not less than 8 inches and will provide acceptable flow.

<u>Transmission Lines</u>: 2,000 feet intervals, except when the Fire Marshall or Public Works Director determine that demand indicates that a lesser spacing is necessary.

Distribution Lines:

<u>Land Use</u>	Maximum Distance
Residential (Single & Multifamily)	500-ft
Manufacturing & Industrial	250-ft
Commercial	500-ft

Hydrants shall comply with AWWA Standard C502, "Fire Hydrants for Ordinary Water Works Service", and shall be equipped with a minimum of one (1) pumper outlet nozzle 4 ½ inches in diameter and two (2) hose nozzles 2 ½ inches in diameter. Threads, nozzle caps, operation nuts and color shall conform to City Standards. Units shall be traffic type with breakable safety clips or flange, and stem with safety coupling located below barrel break line to preclude valve opening. Hydrants shall be dry top type. Outlet nozzles shall be on the same plane, with minimum distance of 18 inches from center of nozzles to ground line. Valve shall be compression type with 5 ¼ inches minimum opening unless otherwise requested and show inlet connection to be 6 inches minimum.

6.2.4 System Size Computations

The minimum design for water distribution systems shall provide for at least 100% of the combined maximum day-demand rate and required fire flow for said rate, with special provisions for peak flows in excess thereof. The allowable minimum service pressure under said design condition shall not be less than 20 pounds per square inch. Design computation shall be by the "Hardy Cross" procedure, or other applicable methods, as dictated by the system configuration.

Design flows and method of computation shall be subject to review and approval by the City.

6.2.5 Valve Locations

Valves shall be provided for all branch connection, loop ends, fire hydrant stubs, or other locations, as required to provide an operable, easily maintained, and repaired water distribution system. A valve shall be required on each leg of every tee and cross. Valves are to be placed so that the maximum allowable length of water main required to be shutdown for repair work shall be 500 feet, for water mains 12" diameter or less. Valves are to be placed so that the maximum allowable length of water main required to be shut down for repair work shall be 250 feet, for water mains larger than 12" in diameter.

No valves shall be placed under roadways or curbs.

6.2.6 Pipe Separation

All water mains shall be installed in accordance with Chapter 62-555.314, F.A.C., and in conformance with all separation requirements a found therein.

6.3 INSTALLATION

6.3.1 General

The materials of construction and general installation procedures, with the exception of fire hydrants, shall comply with the specific applicable standards set forth under Section 2, "Trenching, Backfilling and Compacting for Utilities", Section 3, "Jacking and Boring", Section 4, "Directional Drilling", and Section 5, "Pipe, Fittings, Valves and Appurtenances", as well as "Standard Details-Water Distribution Systems".

6.3.2 Fire Hydrants

Hydrants shall be installed plumb and in true alignment with the connection pipes to the water main. They shall be securely restrained. The gravel or crushed stone for the drain sump, followed by backfilling, shall be carefully placed and compacted. Installed hydrants shall be painted safety yellow for the final coat.

Hydrant placement is to be a minimum of 6 foot and a maximum of 9 foot from the curb or paved road surface unless otherwise approved. The center of the steamer port shall be 18 inched minimum and 24 inches maximum above final grade. Steamer port shall be correctly positioned for the proper connection, with the approval of the City (Water & Fire Department).

All fire hydrants shall be equipped with a GradLock fitting for adjustment of the hydrant elevation.

6.3.3 Joint Restraining

"Mega-Lug" restrained joints shall be provided at all points where the line bends greater than 10 degrees and at all wyes, tees, caps, valves, hydrants and reducers. If

any joints are within the required restrained length they shall be restrained with a restraining harness as required. The restraints will be sized and placed according to the plans or according to the pipe manufacturer's recommendations when not shown on the plans.

6.3.4 Pipe Depth and Protection

The standard minimum cover for water distribution systems shall be 3 feet from the top of the finish grade. However, should this design not be feasible, protective concrete slabs shall be provided over the pipe within the limits of the lesser cover. Where waterways, canals, ditches or other cuts are crossed, ductile iron pipe shall be installed across and to 10 feet each side of the bottom. Additionally, approved utility crossing signs shall be placed on the pipe alignment at each side of the canal, etc. Plans for subaqueous crossings shall be subject to approval by the City Public Works Director.

6.3.5 Connections at Structure

Where pipes are to extend into or through structures, flexible joints are to be provided at the wall face.

6.3.6 Special Exterior Protection for Corrosion

Extra protection shall be provided for underground ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement, through the area of concern. The soil test evaluation to determine the necessity for extra protection in suspect areas shall be set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, ductile iron pipe crossing said utility shall be installed parallel to and within 10 feet of, protection shall also be provided. Steel pipe shall not be installed in severe corrosion areas.

6.3.7 Air Venting and Blow Offs

Where the water main profile is such that an air pocket or entrapment could occur resulting in flow blockage, methods for air release shall be provided. Air venting capabilities shall be provided for distribution mains by appropriately placing fire hydrants, blow-offs, or other manual devices. At critical points on major mains, automatic air release assemblies shall be installed. Special care shall be taken to preclude any cross-connection possibility in the design of automatic air release valve application. All dead-end water mains, temporary or permanent, shall be equipped with a lockable, manually operated blow-off at the terminus.

6.3.8 Service Connections

Connections to water mains 4 inches and larger shall be made by drilling the appropriate size hole and installation of service saddles, with services to smaller sizes accomplished by in-line fittings. A fitting with the service line extended to the property line or easement line, perpendicular to said line, and terminating with a plugged curb stop and meter box, pending meter installation. On curbed streets the exact location for each installed service shall be marked by etching or cutting a "W" in the concrete curb

and painted blue. Where no curb exists or is planned, locations shall be adequately marked by a single ½" steel rebar, 3" below final grade.

6.4 TESTING

- A) The contractor shall perform hydrostatic testing of all water distribution systems, as set forth in the following and shall conduct said tests in the presence of representatives from the City and/or other authorized agencies, with 48 hours advance notice provided, in writing.
- B) Piping and appurtenances to be tested shall be within sections between valves, not exceeding 1500 feet unless alternate methods have received prior approval from the City. Testing shall not proceed restraining until devices are installed. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided if required.
- C) Hydrostatic testing shall be performed at 150 pounds per square inch pressure, unless otherwise approved by the City, for a period of not less than two (2) hours. Testing shall be in accordance with the applicable AWWA provisions for PVC-AWWA Publication M-23 and for DIP-AWWA Standard C600, Section 4. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formulas:

$$L = \frac{\text{ND P}^{1/2}}{7400} \qquad L = \frac{\text{SDP}^{1/2}}{133,200}$$

For 150 psi; test: L = 0.00165 ND (PVC)For 150 psi; test: L = 0.000092 SD (DIP)

L = allowable leakage in gallons per hour
N = number of joints in section tested

S = length of pipe tested, in feet

D = nominal diameter of the pipe in inches

- D) The testing procedure shall include the continued application of the specified pressure to the test system, for the two hour period, by way of a pipe taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container.
- E) Should the test fail, necessary repairs shall be accomplished by the contractor and the test repeated until within the established limits. The contractor shall furnish the necessary labor, water, pumps, gauges and all other items required to conduct the required water distribution system testing and perform necessary repairs. Guages shall be tested certified for accuracy by an authorized agency or individual prior to testing.

F) Pipe sections to be pressure tested shall be subjected to a hydrostatic pressure of 150 psi for a period of 2 hours by means of a pump.

6.5 DISINFECTING

- 6.5.1 Following the pressure testing: the contractor shall disinfect all sections of the water distribution system, and receive approval thereof from the appropriate agencies, prior to placing in service. Advance notice shall be provided to the City before disinfecting procedures start. The disinfection shall be accomplished with the applicable provisions of AWWA Standard C651, "Disinfecting Water Mains" and all appropriate agency approvals. Computation of the amounts of chlorine to be used for disinfection should be approved by the City of its authorized representative.
 - A) Care shall be taken to provide disinfection to the total system and extremities shall be carefully flushed prior to chlorination.

After disinfection and final flushing have been accomplished, samples of water for bacteriological analysis shall be collected and submitted to and as directed by the Florida Department of Environmental Protection or other appropriate approval agency.

Should these samples or subsequent samples prove to be unsatisfactory, then the piping shall be disinfected until a sufficient number of satisfactory samples are obtained.

- B) The Contractor shall furnish all equipment and materials and perform the work necessary for the disinfecting procedures, including additional disinfection as required.
- C) The Contractor shall be responsible for the proper de-chlorination disposal of the water used for disinfection.

SECTION 7 SANITARY GRAVITY SEWERS

7.1 GENERAL

7.2 DESIGN STANDARDS

7.2.1 System Design

7.3 INSTALLATION

- 7.3.1 General
- 7.3.2 Manholes
- 7.3.3 Pipe Depth and Protection
- 7.3.4 Pipe Bedding
- 7.3.5 Connections at Structures
- 7.3.6 Transition Connections
- 7.3.7 Pipe Cutting
- 7.3.8 Service Connections
- 7.3.9 Protection of Water Systems
- 7.3.10 Grease Traps

7.4 POLYVINYL CHLORIDE (PVC) SEWERS

7.5 TESTING

7.6 RECORD DRAWINGS

SECTION 7 SANITARY GRAVITY SEWERS

7.1 GENERAL

This section includes general technical criteria of the City of Groveland for the design and installation of sanitary gravity sewer systems.

7.2 DESIGN STANDARDS

The Developer shall comply with the applicable requirements specified within Water Environment Federation (WEF) Manual of Practice No. 9, Latest Edition; Great Lakes Upper Mississippi River Board of State Public Health & Environmental Managers, "Recommended Standards for Wastewater Systems," Latest Edition (Ten States Standards) and as established by the Florida Department of Environmental Protection.

7.2.1 System Design

A) Average Daily Flow (ADF)

The sewer system design shall be based on full ultimate development as known, or projected. The average daily flow (ADF) from domestic units shall be calculated at the minimum rate of 250 gallons per day per equivalent residential unit (ERC). Single family residences shall be computed at the rate of 3.5 persons per connections and multi-family or mobile home dwellings at 2.5 persons per unit. Flow requirements from commercial, industrial, institutional, or other special development areas shall be established from existing records or by estimated projections using the best available data; however, in no case shall a rate of less than 2,000 gallons per acre per day be used, unless specifically approved otherwise. It shall be stated in the Developers Agreement that sizing of the sewer system shall be the responsibility of the Developer, based upon his anticipated use of the land and flows generated therein. Any future upsizing of onsite improvements due to more intensive uses of the land shall be the responsibility of the Developer.

B) Maximum Daily Flow

Gravity sewers shall be designed on the basis of ultimate development maximum rates of flow. The maximum flow ranges from 2.0 to as a minimum up to a maximum of 4.0 times the cumulative ADF, depending on the number of houses contributing, as recommended by the Recommended Standards for Wastewater Facilities.

C) Sewer Size Computation

Sanitary sewers shall be sized to provide ample capacity for the maximum flow rates. The minimum allowable size for any sewer, other than service connections, shall be 8 inches in diameter. All sewers shall be designed at slopes providing a minimum velocity of not less than 2 feet per second when flowing full or half-full. Said computation shall be based on Manning's Formula using a roughness coefficient ("n") of not less than 0.013, unless justifiably

approved otherwise. In general, the following minimum slopes shall be provided for pipe sizes up to 24 inches diameter:

MINIMUM SLOPE

SEWER SIZE (Feet per 100 feet)

8 inches 0.40

10 inches 0.28

12 inches 0.22

14 inches 0.17

15 inches 0.15

16 inches 0.14

18 inches 0.12

20 inches 0.11

21 inches 0.10

24 inches 0.08

Minimum slopes slightly less than those indicated may be considered in extreme situations; providing the depth of flow will not be less than 0.3 of the pipe diameter or the velocity less than 1.6 feet per second at design average daily flow, and justifiable reasons for the modification are presented to the City.

7.3 INSTALLATION

7.3.1 General

- A) The materials of construction and general installation procedures shall comply with the applicable standards set forth under Section 2, "Trenching, Backfilling and Compaction for Utilities", Section 3, "Jacking and Boring", Section 4, "Directional Drilling", and Section 5, "Pipe, Fittings, Valves and Appurtenances".
- B) Sewers 24 inches in diameter or less shall be installed with straight alignment and grade between manholes, with manhole spacing not to exceed 400 feet for sewers, 15 inches or less, and 500 feet for sizes larger.
- C) All sanitary sewers shall terminate at manholes.

- D) All manholes and sewers shall be located in public Rights-of-Way. No manholes or sewers shall be located in side or back lot easement under any conditions.
- E) Gravity sewer lines shall be required to be extended across the length of any newly developed property to provide continuation of service for future connections.
- F) Any sanitary sewer easement provided on private property shall be required to have a minimum width of 15' and shall be dedicated to the City prior to City acceptance of the system.

7.3.2 Manholes

- A) Manholes shall be precast concrete. The minimum inside diameter of manholes shall be 48 inches for sewer sized to 21 inches in diameter or less, with submittal of special designs for larger pipes. Manholes are to be placed at the ends of jack and bore section for gravity sewer lines.
- B) Precast reinforced manholes shall be in accordance with ASTM Designation C478, with pre-formed flexible plastic joint sealer conforming to Federal Specification SS-S-0210 (GSA-FSS), "Ram-Nek", as manufactured by the K.T. Snyder Co., Inc., Houston, Texas or approved equal.
- C) Manholes are to be located in dedicated rights-of-way.
- D) Manhole frames and covers shall be gray cast iron conforming to ASTM Designation A48, Class 30, and shall have a minimum 22 ¼" opening. Covers shall have no perforations, including pick holes and shall be marked with the word "Sewer". Frames and covers shall be fully bedded in mortar to the correct finish grade elevation, with adjustment brick courses placed below, as detailed for precast manholes. A minimum of one and a maximum of three courses of brick shall be used. There will be no steps allowed in manholes. See attached detail for further information.
- E) Manhole flow channels shall have smooth and carefully shaped bottoms, built up sides and benching constructed from concrete. Channels shall conform to the dimensions of the adjacent pipe and provide changes in size, grade and alignment evenly.
- F) The interior surfaces of all manholes shall be protected by the application of two (2) coats of Koppers Bitumastic No. 300M, or approved equal. Exterior surf aces shall receive two (2) coats of Koppers Bitumastic Black Solution or approved equal.
- G) Sewer clean-outs not in the pavement shall have concrete pads around the top, which will be flush with the top of the curb, with minimum dimensions of 18 to 18 by 3 inches. Sanitary sewer clean-outs shall be required at the property line, in accordance with the attached details.

- H) Manholes shall not be located in drainage swales or any other low area likely to collect or pond water during rains.
- I) A drop manhole connection shall be required for all inverts over 24" above the floor of the manhole, in accordance with the standard details.

7.3.3 Pipe Depth and Protection

The minimum allowable cover for gravity sewers shall be 3 feet from the top of the pipe to finish grade.

7.3.4 Pipe Bedding

Special care shall be exercised in the design and installation to provide adequate bedding for the type of pipe used, taking into consideration trench width and depth, superimposed loading above grade and the material below trench grade.

Pipe loadings capabilities shall be computed in accordance with established design criteria and special supporting bedding or facilities shall be provided as required.

7.3.5 Connections at Structures

Where sanitary sewers connect to structures, pipe joint bell shall not be installed at the wall face. Core bore into the existing manholes and use Kor-N-Seal flexible connectors or approved equal with stainless steel straps on all pipe to manhole connections.

7.3.6 Transition Connections

Where pipes of alternate materials are to be connected between manholes, suitable approved transition couplings shall be installed.

7.3.7 Pipe Cutting

The cutting of pipe shall be performed by the proper tools and methods.

7.3.8 Service Connections

Installation shall be performed using proper methods and following manufacturers' recommendations, including the wye branches installed in the sewer main at the point of connection, and the service pipe and required fittings extended to the property line or easement line. The minimum service pipe size in easements or rights of way shall be 6-inches in diameter up to the property line. On curbed streets, the exact location for each installed service shall be marked by etching or cutting as "S" in the concrete curb, painted green. Where no curb exists or is planned, locations shall be adequately marked by ½" steel rebar, 3" below final grade. A clean-out/plug is required to be installed on all connections st the right-of-way line.

7.3.9 Protection of Water Systems

The horizontal separation between sanitary sewers and existing or proposed water mains shall be in accordance with Chapter 62-555.314, F.A.C.

7.3.10 Grease Traps

Grease traps with a minimum size of 750 gallons shall be required on all connections with any food preparation, floor drains or wash basins (except residential connections). Grease traps and lines shall be separate from the sanitary flow. All grease traps shall have an accessible clean-out on the discharge side of the trap for sampling discharge. All grease traps shall be accessible for inspection and cleaning, and maintenance and cleaning shall be the responsibility of the utility customer. All grease traps shall comply with the requirements of the Florida Building Code, latest edition.

7.4 POLYVINYL CHLORIDE (PVC) SEWERS

A) General

This section includes the material and installation standards for pipe, fittings, and appurtenances as applicable to PVC sanitary gravity sewer systems. The relevant provisions included in these specifications and standards shall be applicable to the Section, unless otherwise indicated herein or approved by the applicable Regulatory Agency.

B) Materials

Polyvinyl Chloride (PVC) pipe and fittings for gravity sewage lines shall be manufactured from polyvinyl chloride resin conforming to ASTM Designation D1784. Pipe and fittings of this material shall conform to ASTM Designation D-3034 of F-949, STANDARD SPECIFICATION FOR TYPE PSM POLYVINYL CHLORIDE (PVC) SEWER PIPE AND FITTINGS. All pipe and fittings shall have a Standard Dimension Ratio (SDR) of not more than thirty-five (35) for sewers 13' deep, or less. For sewers installed at greater than 13' depth, a minimum of SDR 26 PVC pipe shall be used.

C) Pipe Lengths

PVC pipe for gravity sewers shall be furnished in a maximum of thirteen (13) feet lengths, with integrally formed and gasketed bell joints.

D) Joints

PVC pipe and fittings for gravity sewers shall be furnished with joints conforming to ASTM D-3212, Standard Specification for Sewer Pipe Joints using Elastomeric Seals. All pipes shall have a factory installed rubber sealing ring. Field solvent weld fittings shall not be acceptable.

E) Manhole Connections

All holes in manholes and/or wetwells shall be sealed utilizing a Kor-N-Seal boot.

F) Special Backfill

Where the soil in the excavated trench bottom is unsuitable (unstable), the contractor shall over excavate the trench bottom and backfill with crushed stone or gravel defined

as Class I, except sizing shall be $\frac{1}{4}$ " to $\frac{3}{4}$ ", under the U.S.C.S. Soil Classification System (FHA Bulletin No. 373), or crushed shell. In dry conditions, graded sands may be used.

G) PVC Pipe Laying and Backfilling

1) Dewatering Required

Water shall not be allowed in the trenched while the pipe is laid. The use of a dewatering system is a requirement on any runs of pipe where such pipe will be below the ground water elevation at the specific Site. Sump and pump type trenching may be used only on short shallow runs where wellpoints would be impractical and excessively expensive, and only with the prior approval of the City. In all cases, density testing up to a point at least one (1) foot above the water table shall be completed prior to removal of dewatering equipment. On sewer lines installed using dewatering, service laterals shall be installed while the trench is dry.

2) Pipe Alignment

Care must be taken to fit the joints together property so that the centers of the pipes shall be in a straight line. All adjustments to line and grade must be by scraping away or filling in under the barrel of the pipe and not by wedging or blocking up any portion or the pipe. In no case shall the pipe be walked on either before or after the joints have been made. Any pipe that has its grade alignment or joints disturbed will be taken up and re-laid. Pipe shall not be driven to grade by striking it with any unyielding object.

3) Backfill and Deflection

Immediately after the pipe has been Jointed and inspected, backfilling shall be placed to a minimum of twelve (12) inches above the crown of the pipe to adequately protect the pipe from injury and movement, in accordance with ASTM D2321. Before and during the backfilling of any trench, precaution should be taken against flotation of pipe lines therein due to entry of large quantities of water into the trench which could cause uplift of the pipe line. The diameter deflection of PVC pipe shall not exceed five (5) percent after completion and approval of construction, and for a period of one (1) year thereafter.

4) Compaction

The mechanical compaction of backfill over sewer lines and appurtenances, within right-of-way and under all roadways, drives (including dirt drives), and parking areas shall be compacted to ninety-eight (98) percent of maximum density per AASHTO T-180. In unpaved areas outside of the right-of-way, the backfill shall be compacted to a minimum density of ninety-five (95) percent of maximum density.

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7.5 TESTING

- A) The contractor shall perform testing of all sanitary gravity sewers, as set forth in these standards and shall conduct said tests in the presence of representatives from the City and/or other authorized agencies and the Engineer of Record with 48 hours advance notice provided.
- B) Sanitary sewers to be tested shall be within sections. Testing shall not proceed until all facilities are in place and all associated concrete is cured. All piping shall be thoroughly cleaned prior to testing to clear the lines of all foreign matter.
- C) Where the pipe is installed in conditions where the groundwater level is less than two feet above the highest point in the line, the contractor will utilize low-pressure air testing in accordance with Uni-Bell PVC Pipe Association, UNI-B6-98, "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe", latest revisions.
- D) Where groundwater is at least two feet above the lowest point in the line, infiltration testing shall be used. Infiltration shall not exceed 300 gallons per day per inch of diameter per mile as measured between manholes. Testing shall proceed for a continuous period of two (2) hours, with infiltration amounts measured by methods approved by the Public Works Departments. Piezometers or other City-approved methods shall be used to determine the groundwater level.
- E) Should any test fail, necessary repairs shall be accomplished by the Contractor, and the test repeated until the established limits are satisfied. Any repairs shall be performed under the supervision of the City forces and by methods receiving prior approval by the City.
- F) All sanitary gravity sewer lines shall be televised and lamped at the expense of the Owner/Contractor. In the event that the televising of the lines reveals problems (i.e. bellies, lateral deflection, etc), it may also be necessary, at the discretion of the City, to require an approved 9-arm deflection mandrel to be pulled through the sewer to ensure that the line is within acceptable slopes and that deflection does not exceed 5% of the average inside diameter, as established by ASTM standards. Any pipe found to be out of compliance with these specifications, or not meeting the requirements of the City is to be removed and replaced at the expense of the Owner/Contractor.

7.6 RECORD DRAWINGS

Record drawings ("As built plans") shall be prepared by a licensed land surveyor, registered to practice in the State of Florida, reviewed by the engineer of record and be furnished to the City upon completion of project, with actual linear measurements from permanent points to all sewer systems components, including location of each house lateral and reflecting any changes from the approved design plans.

SECTION 8 SANITARY SEWAGE FORCE MAIN

8.1 GENERAL

8.2 DESIGN STANDARDS

- 8.2.1 Reference
- 8.2.2 System Design
- 8.2.3 Operational Cost Considerations

8.3 INSTALLATION

- 8.3.1 General
- 8.3.2 Joint Restraining
- 8.3.3 Pipe Depth and Protection
- 8.3.4 Air and Vacuum Venting
- 8.3.5 Valve Locations
- 8.3.6 Force Main Terminations
- 8.3.7 Clean Out Connections
- 8.3.8 Terminal Discharge
- 8.3.9 Identification

8.4 TESTING

SECTION 8 SANITARY SEWAGE FORCE MAIN

8.1 GENERAL

- A) This section includes the general requirements for design and installation of force main system serving sanitary sewage pumping stations.
- B) The relevant provisions of other sections of The Standard Specifications shall be applicable to this section unless otherwise indicated herein or approved by the City.

8.2 DESIGN STANDARDS

8.2.1 Reference

The Developer shall comply with the applicable criteria set forth in Water Environment Federation (WEF) Manual of Practice No. 9, Latest Edition; Great Lakes Upper Mississippi River Board of State Public Health & Environmental Managers, "Recommended Standards for Wastewater Systems," Latest Edition (Ten States Standards) and as established by the Florida Department of Environmental Protection.

8.2.2 System Design

Force main systems shall be of adequate size to efficiently transmit the total ultimate peak operational flows from the connected sewage pumping station(s) to the effluent point. Future connections of other pump stations and force mains shall be taken into consideration and coordinated with the City of Groveland. Calculations shall be made for the initially proposed pumping system(s), along with any future flow requirements, if applicable in order to provide adequate pipeline cleansing. Force main flow velocity shall not be less than 2 feet per second at ultimate design capacity. However, with multiple pumping station systems or phase development, this requirement may be difficult to meet. Consequently, special attention shall be given to the interim conditions, as regards cleaning, maintenance, pumping rates, future upgrading of systems by changing impellers, pump changes, parallel force mains and other ways to increase future capability.

8.2.3 Operational Cost Considerations

In addition to initial capital expenditure, long term pumping station operational costs shall be considered when sizing force main systems or making decisions concerning whether gravity service or lift station service is to be provided.

8.3 INSTALLATION

8.3.1 General

The materials of construction and general installation procedures shall comply with the specific applicable standards set forth under Section 2, "Utility Excavation, Trenching and Backfilling", Section 3, "Jacking and Boring", Section 4, "Directional Drilling", and Section 5, "Pipe, Fitting, Valves and Appurtenances".

Force main piping shall be 4" or larger.

8.3.2 Joint Restraining

"Mega-Lug" restrained joints shall be provided at all bends, wyes, tees, caps, valves, and reducers. If any joints are within the required restrained length they shall be restrained with a restraining harness as required. The restraints will be sized and placed according to the plans or according to the pipe manufacturer's recommendations when not shown on the plans.

8.3.3 Pipe Depth and Protection

The standard minimum cover for sewage force main systems shall be 36 inches form the top of the pipe to finish grade. Where this condition cannot be met, special consideration will be given. Additional depth may be required where future surface improvements are planned or anticipated.

8.3.4 Air and Vacuum Venting

Where the force main profile is such that air pockets or entrapment could occur, such as local high points in the line that could result in flow blockage, provisions for automatic air release and/or venting shall be provided. Where free flow will occur during operation of after pumping stops, combined air release and vacuum valve assemblies shall be provided.

8.3.5 Valve Locations

Valves shall be installed on all subsidiary force mains at the point of connection to the major main and where force mains are to be extended and at intervals not exceeding 1,000 feet. At future connection branches or ends, the valves shall be restrained by methods to facilitate said connection without system shut down.

8.3.6 Force Main Terminations

Force mains shall typically terminate at wet wells, or force mains. Terminations into gravity sewers are discouraged and shall be avoided whenever possible. When this is unavoidable, prior approval is required from the City and provisions shall be made to direct the flow into the flow channels. Branch connections are not permitted.

8.3.7 Clean Out Connections

Should force mains appear to be susceptible to sedimentation clogging, as created by depressed crossings or extended low flow (velocity) periods, suitable clean out connections shall be provided.

8.3.8 Terminal Discharge

Force mains shall enter the termination point at the operational water level of the connecting point. Should an elevation drop be required to obtain the outlet connection, the prior down-slope of the force main shall not exceed 45 degrees, and adequate air venting shall be provided at the profile breakpoint.

8.3.9 Identification

All installed underground sanitary sewage force mains shall be green (PVC) or HDPE, upsized to match or exceed the internal diameter of the connecting pipe and marked with a continuous green stripe located within the top 90 degrees of the pipe.

8.4 TESTING

- A) The Contractor shall perform hydrostatic testing of all sanitary sewage force mains, as set forth below. Testing shall be conducted in the presence of representatives from the City and other authorized agencies who shall be given 48 hours advance notice. The engineer of record shall also witness the testing.
- B) Piping and appurtenances shall be tested in sections between valves or adequate plugs, not exceeding 2000 feet with prior approval from the City. Testing shall not proceed until restraining devices are installed. All piping shall be thoroughly cleaned prior to testing, to clear the lines of all foreign matter. While the pipe is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section and additional release cocks shall be provided where required.
- C) Hydrostatic testing shall be performed at 125 psi for all force mains, unless otherwise directed by the City. The testing procedure shall continue for an uninterrupted period of not less than two (2) hours. Testing shall be in accordance with the applicable AWWA provisions for PVC-AWWA Publication M-23 and for DIP-AWWA Standard C600, Section 4. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formulas:

PVC DIP
$$L = \frac{ND p^{1/2}}{7400}$$

$$L = \frac{SDp^{1/2}}{133,200}$$

For 100 psi; test: L = 0.00135 ND (PVC)For 100 psi; test: L = 0.000075 SD (DIP)

L = allowable leakage in gallons per hour

N = number of joints in section testing

S = length of pipe tested, in feet

D = nominal diameter of the pipe in inches

P = average test pressure in psi, gauge.

- The testing procedure shall include maintaining the specified pressure to within 5 psi of the test pressure, for the two hour period, using a pump taking supply from a container suitable for measuring water loss. The amount of water pumped into the force main shall be determined by measuring the volume displaced from the container.
- 2) Should the test fail, necessary repairs shall be made by the contractor and the test repeated until the test results fall within the established limits. The

contractor shall furnish the necessary labor, water, pumps, gauges, and all other items required to conduct the required sanitary sewage force main testing and shall perform the necessary system repairs required to comply with the specified hydrostatic test.

- 3) Test gauges shall be tested and calibrated for accuracy by an approved method or agency prior to commencing the test.
- D) All tapping saddles/valves shall be subject to a minimum 15 minute pressure test at 125 psi with no allowable leakage.

SECTION 9 SEWAGE PUMPING STATIONS

9.1 GENERAL

9.2 DESIGN STANDARDS

- 9.2.1 References
- 9.2.2 Design Flow
- 9.2.3 Pump Selection
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SECTION 9 SEWAGE PUMPING STATIONS

9.1 GENERAL

- 9.1.1 This section includes the general requirements for the design criteria and installation of sewage pumping stations.
- 9.1.2 Relevant provisions included in these Standard Specifications shall be applicable to this section, unless otherwise indicated herein or approved by the City.

9.2 DESIGN STANDARDS

9.2.1 Reference

The developer shall comply with the design guidelines established by the Water Environment Federation (WEF) Manual of Practice No. 9, Latest Edition; Great Lakes Upper Mississippi River Board of State Public Health & Environmental Managers, "Recommended Standards for Wastewater Systems," Latest Edition (Ten States Standards) and as established by the Florida Department of Environmental Protection.

9.2.2 Design Flow

Sewage pumping stations shall be designed for the total ultimate development flow from all contributory areas. The design average daily flow shall be computed at the unit rates detailed in Section 7. The maximum required pumping capability shall be the product of selected peak factors times the accumulative average daily flow (ADF) from the total service area. In general, the following factors shall be applicable for the range of flow contributions indicated (million gallons per day average daily flow: MGD – ADF), unless larger valves are required or smaller amounts are justified, with prior approval from the City.

Flow Range	Peak Factor
0.00 to 0.05 MGD-ADF	3.5 to 4.0
0.05 to 0.25 MGD-ADF 0.25 to 2.00 MGD-ADF	3.0 2.5
0.23 to 2.00 MGD-ADI	2.5

Note: Special analysis shall be made for flows beyond 2.0 MDG-ADF and peak factors less than 2.5.

9.2.3 Pump Selection

A) For pumping stations with a peak flow demand of 1,000 gallons per minute (GPM) or less, a minimum of two pump units shall be provided (with one (1) pump operation to meet peak flows, and one (1) pump on standby). Where the peak design flow exceeds 1000 GPM, three or more units shall be included in the facility with two (2) pumps operating to meet maximum demand and one (1) pump on standby. The pumps shall be designed to alternate as lead and lag with each start.

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- B) The selected sewage pump system shall have the minimum capability of pumping the design peak flow at the maximum computed system total dynamic head (TDH) requirements.
- C) Head-Capacity curves shall be prepared for the proposed pumping system in order to determine the various operational conditions. Hydraulic computations shall be in accordance with good engineering, practice, with pipe friction loss calculated by the "Hazen-Williams Formula", using standard friction factors based on the materials utilized.

9.2.4 Wet Well Design

- A) The wet well structure shall provide a minimum capacity between operational water levels sufficient to allow a minimum of five (5) minutes between successive starts of the pumps, when the effluent rate is one-half the maximum one pump capacity. Low water levels shall provide adequate submergence to preclude pump inlet vortexing, air binding or other design considerations. Operational maximum high water levels shall not exceed the invert elevation of the lowest influent pipe, with high water alarm no higher than the 0.8 of the lowest pipe. The bottom of the wet well floor shall slope to the pump intakes at a slope of not less than one to one (1/1). The wet well structure shall be designed to eliminate any possibility of flotation. Calculations shall be provided to the City along with other design calculations.
- B) Odor control shall be provided as required and specified by the City of Groveland Public Works Department.
- C) Lift stations shall be provided with a cast in place HDPE liner where directed by the City.

9.2.5 Station Water System (Non-Potable)

All sewage pumping stations shall be provided with a water system, with adequate capacity and pressure, for wash down and other requirements. The supply shall be completely separated from the potable supply by use of a reduced pressure type backflow preventors or other City approved protective systems. Backflow devices shall be tested by a certified tester within five days of installation, with written results provided to the City.

9.2.6 Emergency Power Provisions – Generators and Emergency Power Connections

All pumping stations shall be provided with an emergency power generator to maintain uninterrupted wastewater flow during periods of commercial power outages. Therefore, all lift stations shall be provided with an onsite standby, diesel, power generator and automatic transfer switch

Stations shall also be equipped with standby power generator connections for emergency auxiliary pumping. Standard generator plugs shall be as follows:

All 240 V, 3PH plugs shall be Russell Stoll Model #JRS2044FR All 480 V, 3PH plugs shall be Russell Stoll Model #JRS2044MR

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All 240 V, 1PH plugs shall be Russell Stoll Model #JRS1044FR

9.2.7 Sewage Pumps, Motors, and Standby Generators

A) Sewage pumping units shall be capable of handling raw, unscreened sewage and shall be capable of passing a sphere of at least 3 inches in diameter. Pumps shall be electric motor driven and of a proven design that has been in sewage service under similar conditions for at least five years.

Pumps shall provide the required peak design performance requirements and be suitable for operation within the total hydraulic range of operation. See attached drawing. Pumps shall be as manufactured by Flygt, Hydromatic or other City approved manufacturer.

B) Pump Motors

Pump motors shall be non-overloading, excluding service factor, throughout the entire operating range of the pumps. Two or more normally closed heat sensing miniature switches connected in series and embedded within the motor windings shall be provided to shut off power and initiate alarm light for motor over-temperature conditions.

C) Pump controls & SCADA System

(Future)

D) Submersible Pump Facilities

Installation shall include the removable pump units, aluminum access frame and cover, stainless steel pipe pump guide bars, pump discharge connection and other necessary appurtenances. The submersible pumping system and accessories shall all be provided by the same manufacturer. All stations shall be supplied with a 3" Kam-Lok quick coupling for emergency by-pass at pumping stations.

E) Factory Built Facilities

Factory built facilities (package stations) shall receive City approval before inclusion in the construction plans.

9.2.8 Valves and Vaults

A) Valve Vaults

Valve vaults must be a minimum of 6 feet by 6 feet (inside dimension), with no less than 12" clearance from the vault walls. The vault must be coated, with Inextol Epoxy inside and outside with a finish coat of 32 mils. All metal on the inside of the valve vault shall also be coated with Inextol Epoxy and will also have a finish coat of 32 mils.

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B) Valves

All valves used in station valve boxes shall be DeZurik or Clow, 100% full flow plug valves.

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SECTION 10

SEWAGE PUMPING STATION RTU/PUMP CONTROL PANEL

(Future)

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SECTION 11

STANDBY DIESEL ENGINE DRIVEN GENERATOR WITH WEATHERPROOF ENCLOSURE

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- 11.1.2 Description of Systems
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11.3 EXECUTION

- 11.3.1 Services
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- 11.3.5 Warranty

SECTION 11 STANDBY DIESEL ENGINE DRIVEN GENERATOR WITH WEATHERPROOF ENCLOSURE

11.1 GENERAL

11.1.1 Scope of Work

- A. Furnish all labor, materials, equipment and incidentals required to install, put into operation, and field test the weatherproof diesel engine driven generator unit and appurtenances as required by the City of Groveland.
- B. These Specifications are intended to give a general description of what is required, but do not cover all details which may vary between acceptable manufacturers. It is, however, intended to cover the furnishing, the shop testing, and delivery and complete installation and field testing, of all materials, equipment and appurtenances for the complete units as herein specified, whether specifically mentioned in these Specifications or not.
- C. For all units there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not. This installation shall incorporate the highest standards for the type of service intended The Contractor is responsible for field testing of the entire installation, instruction of the City operating personnel in the care, operation and maintenance of all equipment and providing the City with 3 copies of O&M manuals.
- D. All standby generator sets to be utilized in the City of Groveland system shall confirm to these specifications and shall be subject to approval of the Public Works Department.

11.1.2 Description of Systems

A. The engine-generator set shall be arranged for automatic starting and stopping, and load transfer upon failure of the normal source of power. The unit controls shall provide for automatic exercising on a weekly basis.

11.1.3 Qualifications

- A. The engine-generator set shall be a UL2200 listed standard product, except as modified by these specifications, of a manufacturer regularly engaged in the production of this type of equipment. The unit to be furnished shall be of proven ability and shall be designed, constructed, and installed in accordance with best practices and methods. To qualify as a manufacturer, the engine must be the principal item manufactured and the completed engine generator set shall be supplied by the manufacturer's authorized distributor only. The distributor shall have a minimum of ten (10) years experience in the field of power generation.
- B. It is the intent of this specification to secure an emergency generator system that had been prototype tested, factory built, production tested, site tested and of the latest commercial design, together with all accessories necessary for a

complete installation as shown on the plans and drawings, and specifications herein. The equipment supplied and installed shall meet the requirements of the NEC, along with all applicable local codes and regulations. All equipment shall be new, of current production of a national firm which manufactures the engine/generator and controls, transfer switch and switchgear, and assembles the emergency generator system as a matched unit so that there is one-source responsibility for warranty, parts and service through a local representative with factory-trained servicemen.

- C. The unit must be of such physical dimensions as to make a good installation in the opinion of the Director of Public Works, in the space provided for the associated pumping station.
- D. The unit shall be assembled in the U.S. with over 50% of the components such as the engine, generator, auxiliary equipment, etc., manufactured in the U.S. by a manufacturer currently engaged in the production of such equipment.
- E. The unit shall be shipped to the jobsite by an authorized engine dealer having a parts and service facility within the State of Florida. In addition, and in order not to penalize the owner and/or City for unnecessary or prolonged periods of time for service or repairs to the emergency system, the bidding generator set supplier mush have no less than eighty percent (80%) of all engine replacement parts locally available at all times. Certified proof of this requirement shall be furnished to the City upon submittal of construction plans.
- F. All materials and parts comprising the units shall be new and unused, of current manufacture, and of the highest grade, free from all defects or imperfections. Workmanship shall conform to the best modern practices. Only new and current models will be considered. The units offered under these Specifications shall be the product of a firm regularly engaged in the production of engine-generator equipment and shall meet the requirements of the Specifications set forth herein. Major exceptions to these Specifications will be considered sufficient cause for rejection of the machines.
- G. The Engine/Generator Unit shall be as manufactured by Cummins Power Generation or City approved equal.

11.1.4 Submittals

- A. Submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimensional drawings, and interconnection diagrams identifying by terminal number each required for interconnection between the generator set, the transfer switch, and the switchgear panels included elsewhere in these specifications.
- B. The Developer shall submit to the Director of Public Works for review in accordance with other sections, complete sets of installation drawings, schematics, and wiring diagrams which shall show details of installation and connections to the work of other sections, including foundation drawings

- showing location and size of foundation bolts for the spring type vibration isolators and brochures covering each item of equipment.
- C. In the event that it is not possible or practical to conform with certain details of the specifications due to different manufacturing techniques, describe completely all nonconforming aspects.
- D. The submittal data for each engine/generator set and weatherproof enclosure shall include, but not necessarily be limited to, the following:
 - 1) Installation drawings showing plan and elevations of the complete generator unit; foundation plan; exhaust silencer; starting battery; battery charger; weatherproof enclosure and base mounted fuel tank.
 - 2) Engine Data:
 - a) MANUFACTURER
 - b) MODEL
 - c) Number of cylinders
 - d) RPm
 - e) Bore x stroke
 - f) BMEP at full rated load
 - g) Piston speed, FPM
 - h) Make and model and descriptive literature of electric governor (where required)
 - i) Fuel consumption rate curves at various loads
 - j) Engine continuous pump drive duty rating (without fan) HP
 - k) Gross engine horsepower to produce generator standby rating (including fan and all parasitic loads) HP
 - 3) Generator Data:
 - a) MANUFACTURER
 - b) Model
 - c) Rated KVA
 - d) Rated SKVA
 - e) Rated kw
 - f) Voltage
 - g) Temperature rise above 40 degree C ambient
 - 1) Stator by thermometer
 - 2) Field by resistance
 - 3) Class of insulation
 - h) Generator efficiency including excitation losses and at 80 percent power factor.
 - 1) Full load
 - 2) ¾ load
 - 3) ½ load

- 4) Generator Unit Control Data:
 - Actual electrical diagrams including schematic diagrams, and interconnection wiring diagrams for all equipment to be provided. Standard preprinted sheets are not acceptable.
 - b) Legends for all devices on all diagrams.
 - c) Sequence of operation explanations for all portions of all schematic wiring diagrams.
- 5) Engine/Generator Unit and Weatherproof Enclosure: Dimensional data shall be given for the Engine/Generator set and for the weatherproof enclosure.
 - a) Weight of skid mounted unit
 - b) Overall length
 - c) Overall width
 - d) Overall height
 - e) Exhaust pipe size
 - f) CFM of air required for combustion and ventilation
 - g) Heat rejected to jacket water and lubricating oil BTU/hr.
 - h) Heat rejected to room by engine and generator BTU/hr.
 - i) Weatherproof enclosure details and certification of manufacturing method per specifications.
 - j) Base fuel tank, venting, fuel connection points and fill cap location.
 - k) Data on all miscellaneous items supplied.
- 6) Optional System Service Contract:
 - a) Equipment Supplier Company
 Name
 Address
 City/State
 Phone Number
 - b) Attach the number of copies required of System Service Contract to submittal.
- 7) Furnish the number of copies required of the MANUFACTURER'S certified shop test record of the complete engine driven generator unit.
- 8) Warranty information.
- E. Submit operating and maintenance data to the Director of Public Works.
- F. Submit equipment manufacturer's Certificate of Installation, Testing, and Instruction to the Director of Public Works.
- G. Submit the written warranty as required in Paragraph 11.3.5 below to the Director of Public Works.

11.1.5 Testing

To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

- A. Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall be utilized for the following tests. Prototype test programs shall include the requirements of NFPA 110 and the following:
 - 1) Maximum power (KW)
 - 2) Maximum motor starting (KVA) instantaneous voltage dip.
 - 3) Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-2240 and 16.40.
 - 4) Governor speed regulation under steady-state and transient conditions.
 - 5) Voltage regulation and generator transient response.
 - 6) Fuel consumption at ¼, ½, ¾, and full load.
 - 7) Harmonic analysis, voltage waveform deviation, and telephone influence factor.
 - 8) Three-phase short circuit tests.
 - 9) Alternator cooling air flow.
 - 10) Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
 - 11) Endurance testing.
- B. Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
 - 1) Single-step load pickup.
 - 2) Transient and steady-state governing.
 - 3) Safety shutdown device testing.
 - 4) Voltage regulation.
 - 5) Rated power.
 - 6) Maximum power.
 - 7) Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.
- C. Site Tests: An installation check, start-up and building load test shall be performed by the manufacturer's local representative. The Director of Public Works, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
 - 1) Fuel, lubrication oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.

- 2) Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator, etc.
- 3) Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage, and phase rotation.
- 4) Automatic start-up by means of simulated power outage to test remoteautomatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator to the nameplate KW rating.

11.1.6 Special Tools and Spare Parts

A. The manufacturer shall furnish two (2) complete spare replacement sets of all filter elements required for the generator unit.

11.2 PRODUCTS

11.2.1 Ratings

- A. The standby rating of the generator set shall not exceed the manufacturer's published prime rating by more than 10%. The gross engine horsepower required to produce the standby rating shall not exceed the manufacturer's published continuous duty rating by more than 150 percent. Continuous duty rating shall be as defined in BS649 or DIN6270 but in no case shall it exceed the manufacturer's published continuous duty rating for the engine as used in continuous rated pump drive applications. The gross engine horsepower required for the generator set standby rating described above shall include all parasitic demands such as generator inefficiencies, fuel pumps, water pumps, radiator fan (for fan cooled models) and all accessories necessary to the unit's proper operation while operating at rated load and at a rotative speed not to exceed 1800 rpm.
- B. The diesel engine driven generator set shall be capable of producing the specified standby kw rating for continuous electrical service during interruption of the normal utility source and shall be certified to this effect by the manufacturer for the actual unit supplied.
- C. The Diesel Engine/Generator Unit shall be rated for 277/480 volts, 3-Phase, 60 Hertz at 0.8 power factor with fan. The engine/generator set shall be suitable for starting two (2) submersible pump motors sequentially with 5 KVA of miscellaneous load on line. Manufacturer shall certify this in writing. Obtaining a motor starting KVA for each pump motor is the responsibility of the Engineer.

11.2.2 Engines

- A. The engine shall be full compression ignition, four cycle, single acting, solid injection engines, either vertical or "V" type. Speed shall not exceed 1800 revolutions per minute at normal full load operation. Multi block engines are not allowed. The engine governor shall be electronic type with a +/- 0.5 percent accuracy. Governor shall be by Cummins EFC, or City approved equal.
- B. The engine shall be capable of satisfactory performance on No. 2 fuel oil (ASTM Designation D396). Diesel engines requiring a premium fuel will not be considered.
- C. The engine shall be capable of operating at light loads for extended periods of time and shall provide a means to reduce carbonization. Periodic cleaning of exhaust ports shall not be required.
- D. The engine shall be equipped with fuel filters, lube oil filters, intake air filters, lube oil cooler, fuel transfer pump, fuel priming pump, service meter, engine driven water pump, and unit mounted instruments. Unit mounted instruments shall include a fuel pressure gauge, water temperature gauge, and lubrication oil pressure gauge. The engine shall be provided with low oil pressure, high water temperature, low coolant level and overspeed safety shutdowns of the manual reset type. Additional instruments and safety shutdowns shall be provided as noted herein.
- E. Injection pumps and injection valves shall be a type not requiring adjustment in service and shall be of a design allowing quick replacement by ordinary mechanics without special diesel experience. The engines shall have an individual mechanical injection pump and injection valve for each cylinder, any one of which may be removed and replaced from parts stock. Fuel injection pumps shall be positive action, constant-stroke pumps, activated by a cam driven by gears from the engine crankshaft. Fuel lines between injection pumps and valves shall be of heavy seamless tubing.
- F. The fuel system shall be equipped with fuel filters having replaceable elements. Filter elements shall be easily removable from their housing for replacing without breaking any fuel line connections, or disturbing the fuel pump, or any other part of the engine. All fuel filters shall be conveniently located in one accessible housing, ahead of the innection pumps so that the fuel will have been thoroughly filtered before it reaches the pump. No screens or filters requiring cleaning or replacement shall be equipped with a built-in gear-type, engine-driven fuel transfer pump, capable of supplying fuel through the filters to the injection pump at constant pressure.
- G. In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter and a water separator in the fuel inlet line to the engine.
- H. The engine shall be provided with removable wet-type cylinder liners of close grained alloy iron, heat treated for proper hardness as required for maximum

- liner life. The cylinder block shall be a one piece stress relieved gray iron casting.
- I. The engine shall have a gear-type lubricating oil pump for supplying oil under pressure to main bearings, crank pin bearings, pistons, piston pins, timing gears, camshaft bearings, valve rocker mechanism and governor. Effective lubricating oil filters shall be provided and so located and connected that all oil being circulated is continuously filtered and cleaned. Filter shall be accessible, easily removed and cleaned and shall be equipped with a spring-loaded bypass valve as an insurance against stopping of lubricating oil circulation in the event the filters become clogged. The engine shall have a suitable water cooled lubricating oil cooler.
- J. The engine shall be provided with one or more engine mounted dry type air cleaners of sufficient capacity to effectively protect the working parts of the engine from dust and grit.
- K. During each initial start of the engine, a system shall be provided to pre-lube at low idle speed. When the internal oil pressure reaches a predetermined safe value, the engine will then increase to generator set operation speed.
- L. Mounting: The unit shall be mounted on a structural steel sub-base and shall be provided with spring type vibration isolators.

11.2.3 Cooling System

- A. The engine shall be furnished with a unit mounted radiator-type cooling system having sufficient capacity for cooling the engine when the diesel generator set is delivering full rated load in an ambient temperature not to exceed 122 degrees F. The engine shall be provided with a thermostatic valve placed in the jacket water outlet between the engine and the cooling source. This valve shall maintain the proper jacket water temperature under all load conditions. Total air restriction form the radiator shall not exceed 0.5 inches of water at both inlet and outlet. A flexible connecting section shall be provided between the radiator and discharge louver frame.
- B. Closed circuit jacket water systems shall be treated with a rust inhibitor as recommended by the engine MANUFACTURER.
- C. Provide one (1) or two (2) unit mounted thermal circulation type water heaters incorporating a thermostatic switch shall be furnished to maintain engine jacket water at minimum of 70 degrees F. The heaters shall be 120 volt, single phase, 60 Hertz, size as required to achieve above noted ambient.
- D. The expansion tank of the radiator shall be fitted with a low water level switch and wired into the safety shutdown system of the unit.
- E. All fuel piping shall be installed in containment piping.

11.2.4 Generator, Exciter and Accessories

- A. Rating: The generator shall be rated 0.8 p.f., 1800 RPM 3 phase, 60 Hertz, 277/480 volts, 4 leads, with a maximum temperature rise of 105 degrees C (both armature and field) by resistance at full rated load in ambient air of 40 degrees C. The generator shall conform to NEMA Standard MG-1. The generator shall be oversized to allow starting 2 motors (Code letter to be provided by the Contractor) across the line, sequentially, with 5 KVA of miscellaneous load on line.
- B. Performance: The instantaneous voltage dip shall not exceed 20 percent of rated voltage when full load, at rated power factor, is suddenly applied. Recovery of stable operation shall occur within 5 seconds. Steady state modulation shall not exceed +1/2 percent.

C. Construction:

- 1. The generator and exciter shall be drip proof, with split sleeve, or ball race bearings. A shaft-mounted brushless exciter shall be a part of the assembly. The stator core shall be built up of high grade silicon steel laminations, precision punched, and individually insulated. Armature lamination followers and frame ribs shall be welded integral with the frames for support of the stator core. A directional blower shall be mounted on the unit to draw cooling air from the exciter and over the rotor poles and through louvered openings on the opposite end.
- 2. The exciter shall be a fast response type, with a rotating 3-phase full-wave bridge. The exciter shall have a low time constant and large capacity to minimize voltage transients under severe load changes.
- 3. Generator stator and exciter stator windings shall be a full Class H insulated system vacuum impregnated with epoxy resin which after curing shall have additional treatment of epoxy for resistance to an environment of moisture and salt air. Generator coils shall be random or machine wound, and precision made, with turn-to-turn and ground insulation of glass yard and mica materials. The average di-electric strength for the form wound coils of the ground and end turn insulation shall not be less than 400 volts per mil. Spacers shall be tightly secured between end turns, and end turn assembly securely lashed to the support rings.
- 4. Generator rotor poles shall be built up of individually insulated silicon steel punchings. Poles shall be wound and bonded with high strength epoxy resin. Cage connections to the amortisseur rings shall be brazed for strong construction and permanent electrical characteristics. Each pole shall be securely bolted to the rotor shaft with bolts sized for the centrifugal forces on the rotor. Generator windings shall be braced for full line to ground fault currents, with solidly grounded neutral system.

D. Accessories and Attachments

- Low Voltage Terminal Boxes: The generator shall have separate AC and DC low voltage terminal boxes with suitably numbered terminal strip for required connections.
- 2. All required P.T.'s, C.T.'s and protective relays shall be supplied by the engine-generator MANUFACTURER as required.
- 3. Space Heaters: Space heaters shall be installed on the generator frame to maintain temperature of the entire generator above the dew point while not in use. Power supply shall be 120 volts single phase. Heaters will be automatically disconnected when engine starts. The magnetic starter for the heaters shall be mounted in the terminal box. Furnishing and installation of control and starter to be by engine/generator supplier.

E. Generator Associated Controls:

1. Voltage Regulator:

- a. The generator manufacturer shall furnish a hermetically sealed, silicon controlled rectifier type voltage regulator employing a zener reference with a +1 percent regulation for the generator. The regulator shall include 3-phase voltage sensing, automatic short circuit protection and shall include automatic under frequency protection to allow the generator to operate at no load at less than synchronous speed for engine start-up and shutdown procedures. Switches and/or fuses shall not be used to provide this protection. An over-voltage sensing module with manual reset shall be furnished with the regulator. A volts per Hz, sensing module shall be provided as part of the regulation system.
- b. A voltage adjustment rheostat for 5 percent voltage adjustment on the unit shall be provided.
- High voltage step-down potential transformers shall be provided for the voltage regulator power input and sensing circuits if required.
- 2. Sustained Short Circuit: A permanent magnetic exciter shall be provided on the unit for sustaining a current of 300 percent during a short circuit, permitting the generator breaker to trip on overload. To prevent possible overheating of the armature windings, appropriate relaying shall be supplied to limit the fault to ten seconds. All current transformers required shall be supplied by the switchgear MANUFACTURER.

11.2.5 Weather-Protective Enclosure

A. The intent of this specification is to provide the City of Groveland with a weatherproof sound attenuated generator set enclosure complete in every

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detail and requiring no additional in-field modifications or assembly, except where specifically allowed by these specifications. The enclosure is to be accurately dimensioned so as to be in compliance with the National Electrical Code (NEC), and the National Fire Protection Association (NFPA) for clearance of all specified items included therein, and all applicable fire codes for a structure and application of this type.

- B. Construction drawings, engineering blueprints, or other bid documents accompanying these specifications which show switchgear, transfer switch(es), motor controllers(s), and/or other service or distribution equipment within the generator set enclosure must be considered complimentary to and not in lieu of this written specification. Drawings submitted for approval shall reflect this fact clearly and any contradiction or omission shall be brought to the attention of the Director of Public Works.
- C. The enclosure shall be of sheet metal construction as designed and manufactured by the generator supplier. The design and construction shall be modular in that the side panels, doors, and louvers shall not exceed 36 inches in width and shall be a minimum thickness of 14 gauge for all component parts. The roof of the enclosure shall meet or exceed the minimum gauge requirements specified but, in addition, shall be strengthened in such a manner as to support the largest commercially available exhaust silencer recommended by the MANUFACTURER for this application.
 - Construction All sheet metal used in the construction shall be primed and painted. This sequence of metal forming, and final assembly of the enclosure must be noted on the drawings submitted for approval and a factory certification of this manufacturing process shall accompany the record ("as-built") drawings provided to the City. Walls and roof shall be constructed of 14 gauge steel.
 - 2. Attenuation The enclosure will be designed to provide a noise emission rating of 76 decibels at a distance of 23 feet form any point on the generator. Utilize plenum if necessary to meet this requirement.
 - 3. Doors All doors on the enclosure shall be strategically located in areas as to allow ease of maintenance on the generator set and allow good access to and visibility of instruments, controls, engine gauges, etc. The doors shall be fitted with bolt-on, stainless steel hinges constructed with stainless steel hinge pins of a diameter not less than 0.25-inch (1/4-inch). Each door shall be fitted with flushmounted, adjustable, key-lock latches. Enclosure shall be rated for 110 MPH constant wind. Certified calculations shall be provided.
 - 4. Louvers All louvers fixed and drainable with bird screen and shall be designed to the total engine/generator cooling air

requirements used in this application. Maximum air velocity shall be 700 CFM. Manufacturer shall submit air flow calculations to engineer for review.

- 5. Components All components of the enclosure shall be assembled utilizing 0.375-inch minimum stainless steel bolts, nuts, and lock washers. In addition, watertight neoprene flat washers shall be used on all roof bolts.
- 6. The manufacturer of the enclosure shall provide mounting brackets for the exhaust silencer specified. In addition, a tail pipe extension terminating in a horizontal plane and cut at a 45° angle to prevent the stainless steel, seamless flexible exhaust tube and all necessary bolts, flanges, and gaskets to mate with the engine and the exhaust silencer shall be provided. The length of the flexible tubing shall be such that additional solid metal nipples or sections shall not be required to be provided as spacers between the engine exhaust port or the exhaust silencer.
- 7. All wiring to the switchgear from the generator shall be in conduits made from Rigid Metal, IMC, or liquid-tight material specifically manufactured for electrical use. All connections at the generator set shall be flexible, and all shall be provided and installed by enclosure manufacturer.
- 8. Oil and Water Drains All necessary fittings, hoses, shut-off valves, etc., shall be provided by the manufacturer of the enclosure to facilitate lube oil and water drain at the exterior of the enclosure. In addition, engines equipped with crank-case breather tubes shall have this tube terminate at the exterior of the enclosure directly under the radiator air discharge louver.
- 9. Enclosure The enclosure shall be skintight construction to meet specific project requirements.
- 10. Under no circumstances shall the floor area or any of its parts be considered for cooling air intake or discharge requirements of the generator set or its associated equipment, nor shall its properties as a "heat-sink" or heat dissipating medium be utilized in any manner whatsoever in this application.
- 11. All items specified herein shall be supplied and prewired and/or pre installed including, but not limited to the following:
 - a. Rain dress for exhaust pipe and tail pipe extension. Rain dress should prevent the entrance of rain and allow for the expansion and vibration of the exhaust piping without stress to the exhaust system. Rain dress shall be stainless steel and provided by the enclosure supplier.

b. Coordination between contractor and supplier is mandatory and the equipment supplier's instructions will be adhered to without exception.

11.2.6 Fuel System

- A. Base and Mounting The generator set and enclosure shall be mounted and shipped to the jobsite on the formed steel sub-base provided by generator supplier. Provisions for crane unloading of the complete package shall be designed into the base of the unit.
- B. The base and enclosure assembly allow room within the package to mount and maintain the specified battery charger, engine starting batteries, racks, and cables, main line circuit breaker, and engine-generator control panel, and other items as specified or as shown on the drawings.
- C. The weight of the entire unit consisting of generator set, base, enclosure, and all other specified items including all liquids (i.e., fuel oil, lube oil, and cooling water) shall be calculated by the manufacturer. The base of the unit shall be designed and manufactured as a heavy duty, formed steel construction with four (4) point lifting provision to support the calculated weight. Details and manufacturer's certification of the base construction shall be included with drawings submitted for approval as well as all weight calculations.
- D. Base Tank (UL142) The unit shall be equipped with a double wall in-base fuel tank and shall be supplied with a lockable, exterior located fill cap. The capacity (gallon) of the base tank shall permit operation of the generator for 3 days at 75 percent load. All necessary fuel and vent lines for proper engine performance shall be provided as well as a means to readily detect the fuel level in the tank without the use of a measuring stick.
- E. The fuel tank base dimensions shall be full size of the generator base and be formed form steel of a minimum metal thickness of 0.25-inch (1/4-inch) and shall be fitted with low fuel level and inner wall leak alarm contact for local and remote annunciation. The fuel tank height shall not exceed 30 inches.
- F. Filter/Separator-In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine. The filter shall be a Fleetguard, Racor, simplex or duplex Model 1000, as required for proper fuel flow. It shall be supplied and installed by the enclosure supplier.

11.2.7 Exhaust System

A. Exhaust Silencer – A critical type side inlet, end outlet, Nelson, Maxim M-51, or Silex JB silencer and a flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation. Mounting shall be provided by the contractor as required. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust back

- pressure does not exceed the maximum limitations specified by the engine manufacturer. So called "spiral" or truck mufflers are disallowed and will not be considered as equal to the industrial quality silencers specified above.
- B. The silencer shall be fitted with a tail pipe extension termination terminating at a 45° angle to prevent the entrance of rainwater. It shall also be fitted with an expanded metal bird screen.
- C. Rain Skirt At the point where the exhaust pipe flexible tubing penetrates the roof of the enclosure, a suitable "rain skirt" and collar shall be provided by the manufacturer. It shall be designed to prevent the entrance of rain and allow for expansion and vibration of the exhaust piping without chafing of stress to the exhaust system. This detail must appear on the drawings submitted for approval.

11.2.8 Automatic Starting System

- A. Starting Motor A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be 24 volts.
- B. Automatic Control Fully automatic engine start-stop controls in the generator control panel shall be provided. Controls shall provide shutdown for low oil pressure, high water temperature, overspeed, overcrank, and loss of engine coolant. Alarms for approaching high water temperature and impending low oil pressure shall also be included. Controls shall include a 45-second single cranking cycle limit with lockout or a cyclic crank system with lockout and overcrank protection.
- C. Batteries A lead-acid storage battery set of the heavy duty diesel starting type shall be provided. Battery voltage shall be 24 volts, and the battery set shall be rated no less than 225 ampere hours. Necessary cables and clamps shall be provided.
- D. Battery Tray battery tray shall be provided for the batteries and shall conform to NEC 480-7(b). It shall be constructed of fiberglass and so treated as to be resistant to deterioration by battery electrolyte. Further, construction shall be such that any spillage or boil-over of battery electrolyte shall be contained within the tray to prevent a direct path to ground.
- E. Battery Charger A current-limiting, automatic 24 volt DC charger shall be furnished to automatically recharge batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC voltmeter, and fused AC input. AC input voltage shall be 120 volts, single phase. Amperage output shall be no less than ten (10) amperes. Charger shall be wall mounting type in NEMA 1 enclosure, and U.L. listed as an industrial control panel. The charger shall be mounted and wired within the enclosure for the generator set by enclosure manufacturer.

11.2.9 Main Line Circuit Breaker

- A. Type Main line, molded case circuit breaker mounted upon and sized to the output of the generator shall be installed as a load circuit interrupting and protection device. It shall operate both manually for normal switching functions and automatically during overload and short circuit conditions. The breaker shall include ground fault sensing that will trip the breaker on ground fault conditions.
- B. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters Laboratories, National Electric Manufacturers Association, and National Electrical Code.
- C. Generator exciter field circuit breakers do not meet the above electrical standards and are unacceptable for line protection.
- D. Circuit breaker shall have battery voltage operated shunt trip wired to safety shutdowns to open the breaker in the event of engine failure.
- E. Each circuit breaker shall be equipped with an auxiliary contact for remote annunciation of breaker position.
- F. The rating of each circuit breaker shall allow the starting of full generator SKVA.
- G. The circuit breaker enclosure, together with all specified circuit breakers, shall be designed for the specific generator set specified and be equipped with an isolated neutral conductor bus, rear copper stabs, or load cable lugs and be finish painted to match the generator set.

11.2.10 Generator Control Panel

Generator set Control. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control shall include the following features and functions:

A. Control Switches

 Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the

operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

- 2. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out form automatic restarting.
- 3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
- 4. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.
- B. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:
 - 1. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
 - 2. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.
 - 3. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

C. Generator Set Alarm and Status Display

- 1. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:
- 2. The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for function, color, and control action (status, warning, or shutdown).
- 3. The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be

based on actual sensed voltage and frequency on the output terminals of the generator set.

- 4. The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.
- 5. The control shall include an amber common warning indication lamp.
- 6. The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:

Emergency Stop (Shutdown) Low Oil Pressure (Alarm)

Low Oil Pressure (Shutdown)

Oil Pressure Sender Failure (Alarm)

Low Coolant Temperature (Alarm)

High Coolant Temperature (Alarm)

High Coolant Temperature (Shutdown)

High Oil Temperature (Warning)

Engine Temperature Sender Failure (Alarm)

Low Coolant Level (Alarm Or Shutdown--Selectable)

Fail To Crank (Shutdown)

Fail To Start/Overcrank (Shutdown)

Overspeed (Shutdown)

Low Dc Voltage (Alarm)

High Dc Voltage (Alarm)

Weak Battery (Alarm) Low

Fuel-Daytank (Alarm)

High Ac Voltage (Shutdown)

Low Ac Voltage (Shutdown)

Under Frequency (Shutdown)

Over Current (Warning) Over

Current (Shutdown) Short

Circuit (Shutdown) Over

Load (Alarm)

- 7. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.
- 8. The control shutdown fault conditions shall be configurable for fault bypass.
- D. Engine Status Monitoring.
 - 1. The following information shall be available from a digital status panel on the generator set control:

Engine Oil Pressure (Psi Or Kpa)
Engine Coolant Temperature (Degrees F Or C)
Engine Oil Temperature (Degrees F Or C)
Engine Speed (Rpm)
Number Of Hours Of Operation (Hours)
Number Of Start Attempts
Battery Voltage (DC Volts)

2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

E. Engine Control Functions

- The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
- 2. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
- 3. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
- 4. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
- 5. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

F. Alternator Control Functions:

1. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be

capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

- 2. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
- 3. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contracts (for use in shedding customer load devices) when the generator set is overloaded.
- 4. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

G. Other Control Functions

- The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network.
- 2. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25 VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

H. Control Interfaces for Remote Monitoring:

- 1. The control system shall provide four programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown, (4) load shed command.
- 2. A fused 10 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.
- 3. A fused 10 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
- 4. The control shall be provided with a direct serial communication link for the LonWorks communication network interface as described elsewhere in this specification and shown on the drawings.

11.2.11 Automatic Load Transfer Switch

- A. The rating of the automatic load transfer switch (ATS) shall be sized to the station main breaker rating. The ATS shall be service entrance rated if required by the NEC.
- B. The automatic transfer switch shall be mechanically held on both the emergency and the normal side, and rated for continuous duty in an unventilated enclosure. The switch shall be solid-state, electronically controlled, double throw with the main contracts rigidly and mechanically interlocked to ensure positive positioning of power switches. A manual operator must be provide to enable one (1) hand manual operation which, when utilized, can provide a neutral position for servicing operations.
- C. The automatic transfer switch shall be a single motor operated circuit breaker type with interpole barriers and arc chutes. So-called linear actuated or solenoid operated switches are approved only when manufactured by the Generator manufacturer. All elements of the drive system must be replaceable from the front of the switch, and the power switching devices must be replaceable without removal of the connecting cables.
- D. The transfer switch shall be listed under U.L. 1008, in NEMA 4X stainless steel enclosure, as manufactured by Cummins, Russelectric, or Lakeshore Electric.
- E. Accessories The automatic load transfer switch specified shall include the following accessories:
 - 1. Full phase protection. Solid-state phase monitor shall be field adjustable, close differential type, with 85-100% pick-up and 75-98% drop-out. A single adjustment shall set all phases.

- 2. Solid-state voltage and frequency monitor on generator output to prevent transfer prior to proper output parameters, adjustable 85-100% of generator rated voltage and frequency, with adjustable drop-out of 75-85% of pick-up setting.
- 3. Adjustable, solid-state, 0.5 to 6 seconds time delay on engine staring to override momentary outages and nuisance voltage dips.
- 4. Adjustable, solid-state, 2 to 30 minutes time delay on retransfer of load to normal.
- 5. Adjustable, solid-state, 2 to 30 minutes cool-down timer wherein the generator set runs unloaded after retransfer to line.
- 6. Motor load decay time delay, pneumatic type, adjustable for 1.5 to 15 seconds and operation on transfer to either source.
- 7. Adjustable, solid-state, 0.5 seconds to 5 minutes time delay on transfer to emergency source after verification of emergency source voltage and frequency.
- 8. Test switch to simulate normal power failure, heavy duty, oil tight, pushbutton type with momentary contacts and override circuitry to revert to normal power if emergency source should fail during test.
- 9. Motor circuit disconnect switch.
- 10. Three (3) pilot lights, to indicate the normal and emergency position of the transfer switch, and mode selector switch in "off" position.
- 11. Engine starting contacts to provide for generator starting from each unit independent of the other.
- 12. One (1) auxiliary S.P.D.T. contact on emergency breaker and one (1) S.P.D.T. auxiliary contact on normal breaker.
- 13. Plant exerciser to start and run the generator set with or without load (infield switchable) each 168 hours for a 30 minute interval.
- 14. Four (4) position mode selector switch marked "test", "auto", "off", and "engine start".
- 15. Equipment grounding lug.
- 16. Cable connection lugs, cu/al type for all conductors.
- 17. The ATS shall be either solid neutral or switched neutral design as required by the City.

11.3 EXECUTION

11.3.1 Services

- A. Furnish the services of a competent and experienced manufacturer's field service technician who has complete knowledge of proper operation and maintenance of the equipment for a period of not less than two (2) days in two separate visits to inspect the installed equipment, supervise the initial test run, and to provide instructions to the plant personnel. The first visit will be for checking and inspecting the equipment after it is installed.
- B. At least one (1) of the two (2) days shall be allocated solely to the instruction of plant personnel in operation and maintenance of the equipment. This instruction period shall be scheduled at least ten days in advance with the City and shall take place during plant start-up and acceptance by the City.
- C. Three final copies of operation and maintenance manuals specified must be delivered to the City prior to scheduling the instruction period.

11.3.2 Painting

A. The engine generator set and associated equipment shall be shop primed and finish coated in accordance with the manufacturer's standard practice prior to shipment. An adequate supply of touch-up paint shall be supplied by the manufacturer.

11.3.3 Testing

- A. The engine-generator set shall be given the manufacturer's standard factory load test prior to shipment.
- B. Prior to final acceptance of the generator set, all equipment furnished under this Section shall be field tested per NFPA 110 to show it is free of any defects and the generator set can operate satisfactorily under full load test using resistance type load banks (brine tanks not acceptable). Test shall be for four (4) continuous hours. Any defects which become evident at this time shall be corrected before acceptance.
- C. An all-in-place static alignment check of all rotating components shall be made prior to first start-up, after unit is secured in place and all final connections are made.

11.3.4 System Service Contract

A. The supplier of the standby power system must provide a copy of and make available to the City his standard service contract which, at the City's option, may be accepted or refused. This contract will accompany documents, drawings, catalog cuts, specification sheets, wiring or outline drawings, etc., submitted for approval to the Director of Public Works. The contract shall be for the complete services rendered over a period of one (1) year.

11.3.5 Warranty

A. Equipment furnished under this Section shall be guaranteed against defective parts and workmanship under terms of the manufacturer's and dealer's warranty. But, in no event, shall it be for a period of less than five (5) years (comprehensive) from date of initial start-up of the system and shall include labor, parts and travel time for necessary repairs at the job site. Running hours shall not be a limiting factor for the system warranty either by the manufacturer or the supplying dealer. Submittal data received without written warranties as specified will be rejected in their entirety.

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12.11 STORM SEWER DESIGN

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12.12 CULVERT DESIGN

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SECTION 12 STORMWATER TECHNICAL REQUIREMENTS

12.1 REQUIRED FEATURES

A stormwater management system shall be designed and installed for all developments within the jurisdiction of the City of Groveland that will contain features to provide for:

12.1.1 Pollution Abatement

Pollution abatement will be accomplished by retention, or detention with filtration in accordance with St. Johns River Water Management District (SJRWMD) criteria.

12.1.2 Protection from Flooding

Protection from flooding will be accomplished by a design which will provide that:

- a. The post-development peak rate of discharge permitted from the site will not exceed the predevelopment peak rate of discharge from the site during a 25-year frequency/24-hour duration storm event.
- b. All residential structures are to be flood free and all commercial and industrial structures are to be either flood free or flood-proofed.

12.1.3 No Positive Outfall

When a positive outfall is not available, the site shall be designed to retain 100-year frequency/24-hour duration storm on-site

12.2 DISPOSITION OF RUNOFF

- 12.2.1 All development will be required to pretreat the required volume of runoff for pollution abatement purposes. Pretreatment of this volume of runoff is defined as retention (no surface discharge) or detention with filtration (surface discharge) prior to release.
- 12.2.2 Off-site easements for stormwater management facilities will be required when either of the following conditions exists:
 - 12.2.2.1 The discharge is into any man-made facility for which the City does not have either a drainage easement or right-of-way; or
 - 12.2.2.2 The discharge is into a natural system such that the rate or character (i.e., sheetflow vs. concentrated flow) of the flow at the

property line has been changed. The easement will be required to a point at which natural conditions are duplicated.

12.3 DEVELOPMENT WITHIN AREAS OF SPECIAL FLOOD HAZARD

- 12.3.1 All developments within areas of special flood hazard as delineated on the Federal Emergency Management Agency (FEMA) flood insurance rate maps (FIRM) or as determined by the representative of the Public Works Director shall comply with the following requirements:
 - 12.3.1.1 Establish, to the satisfaction of the Public Works Director, the elevation of the base flood (100-year flood). The elevation as approved by the Public Works Director shall be clearly identified on the subdivision lot grading plans. Supporting calculations to determine the Normal High Water Elevation (NHWE) and 100-year flood elevation must be submitted for review and approval by the Public Works Director.
 - 12.3.1.2 Set the minimum finished floor elevation at least one (1) foot above the elevation of the base flood.
 - 12.3.1.3 For commercial or industrial developments, flood proofing may be substituted in lieu of elevating the finished floor.
 - 12.3.1.4 Provide compensating storage for all flood water displaced by development below the elevation of the one-hundred-year flood.

12.4. DRAINAGE DESIGN REQUIREMENTS

12.4.1 Drainage Map

The Engineer of Record shall include in the subdivision construction plans a master drainage map showing all existing and proposed features. The map is to be prepared on a twenty-four (24) inch by thirty-six (36) inch sheet on a scale not to exceed one (1) inch equals two hundred (200) feet. Listed below are the features that are to be included on the drainage map.

- 12.4.1.1 Drainage bounds, including all offsite areas draining to the proposed subdivision.
- 12.4.1.2 Sufficient topographical information with elevations to verify the location of all ridges, streams, etc. (one-foot contour intervals).
- 12.4.1.3 Notes indicating sources of high water data.
- 12.4.1.4 Drainage features, including location of inlets, swales, ponding areas, and flow arrows.
- 12.4.1.5 Delineation of drainage sub-areas.

- 12.4.1.6 Identification of retention/detention areas and ingress/egress areas thereto.
- 12.4.1.7 General type of soils (obtain from soil survey of Lake County.
- 12.4.1.8 Flood hazard classification.
- 12.4.1.9 Description of current ground cover and/or land use.
- 12.4.1.10 NHWE designation for all surface water bodies.
- 12.4.1.11 All storm sewer pipes and sizes.

12.4.2 Subsoil Investigation

A subsoil report shall be prepared by a geotechnical engineer. A minimum of two (2) borings will be taken per retention/detention area.

12.4.3 Stormwater Calculations

Stormwater calculations for retention/detention areas, including design high water elevations for the 25-year frequency, 24-hour duration and 100-year frequency/24-hour duration storm events, shall include the following:

- 12.4.3.1 Storm sewer tabulation including, but not limited to, the following:
 - a. Location and types of structures.
 - b. Types and lengths of line.
 - c. Drainage and sub-area tributary to each structure.
 - d. Runoff coefficient per sub-area.
 - e. Time of concentration to structure.
 - f. Hydraulic gradient for the 10-year storm.
 - g. Estimated receiving water (tailwater) elevation with sources of information, if available.
 - h. Diameters of pipe.
 - i. Outlet and other pipe velocities.
- 12.4.3.2 Drainage plans including, but not limited to, the following:
 - Cross-section of retention/detention facilities.
 - b. Typical swale, ditch or canal sections.
 - c. Drainage right-of-ways.
 - d. Typical fencing detail.
 - e. A note on the design plans that an erosion control plan will be approved by the Public Works Director prior to the preconstruction conference.

12.4.3.3 Routing Calculations

Include the following:

- a. Identify the location of all storage areas and hydraulic structures on the basin map.
- b. A schematic drawing (i.e., nodal diagram) showing the interconnection of the hydrologic/hydraulic network.
- c. Stage vs. storage/area/time calculations with references and methodology.
 - Hydrologic parameters required to calculate the hydrograph such as drainage area, time of concentration, run-off coefficient and runoff curve number.
 - ii. Peak stage, peak outflow, and peak velocity results for the simulated design storm event, including all computer printouts of input and output.
 - iii. Additional information that the Public Works Director deems necessary.

12.5 GENERAL DESIGN CRITERIA

12.5.1 Methods of Computing Runoff Volume and Peak Rate of Discharge

The design method used to establish runoff volume and peak rate of discharge shall be by current techniques. In order to provide for reasonable measures of consistency, the following methods of computation are encouraged to be used:

- 12.5.1.1 Basins or sub-basins (for pipe network analysis). The rational formula may be used to determine peak discharges by the formula Q= CIA, where:
 - Q = Peak Discharge in cubic feet per second (CFS)
 - I = Intensity of rainfall derived from FDOT rainfall charts and the time of concentration for the basin.
 - A = Area contributing in acres.
 - C = Runoff coefficient.
- 12.5.1.2 Basins or sub-basins (for pond routing). Hydrograph(s) should be developed by the United States Department of Agriculture (U.S.D.A.) Soil Conservation Service's Unit-Hydrograph method or by the modified Santa Barbara Urban Hydrograph method. The current Soil Survey of Lake County, Florida published by the United States Department of Agriculture Soil Conservation Service or site-specific data submitted by a geotechnical engineer shall be referred to for the proper use of soils classification when calculating runoff curve numbers.

12.6 DESIGN STORM

12.6.1 The following minimum design storms shall apply:

<u>Facility</u> <u>Design Storm</u>

Cross drains, storm sewers 10-year

Roadside swales for drainage internal 10-year

to the development

Detention basins 25-year

Retention basins (no positive outfall) 100-year

12.7 STORM DURATION AND RAINFALL INTENSITY

- 12.7.1 The following guidelines are for use in the design of the stormwater management system. For the rational method, time of concentration (TC) will dictate the rainfall intensity. Rainfall intensities for the rational method are to be obtained from the Florida Department of Transportation Rainfall Curves. TC values are to be obtained from the Federal Highway Administration Kinematic Wave Formula for sheet or overland flows, and from the Manning Equation for concentrated flows (i.e., gutter flow, ditch flow, pipe flow, etc.)
- 12.7.2 Rainfall distributions for the above are to be in accordance with the St. Johns River Water Management District.

12.8 RETENTION, DETENTION FACILITIES

12.8.1 Pollution Abatement Volume Recovery Rate

The pollution abatement volume recovery rate shall be as required by the St. Johns River Water Management District.

12.8.2 Design Criteria for Detention Facilities to Reduce Peak Rate of Discharge for 25-year Frequency/24-hour Duration Storm

The detention pond will be sized to limit the peak rate of discharge from the developed site to that discharge generated prior to development. Supporting calculations shall be submitted and will contain, as a minimum, runoff hydrographs for the pre-developed site and the post-developed site, and a discharge hydrograph after routing through the proposed detention facility. All routing calculations to be submitted must consider the tailwater of the receiving facility. If the receiving facility is an existing storm sewer, the Hydraulic Gradient Line (HGL) elevation of this receiving facility can be assumed at one-half (1/2) foot below its crown of pipe elevation unless a detailed study of the existing system indicates otherwise.

- 12.8.2.1 Credit for seepage to further reduce the peak rate of discharge will not be allowed.
- 12.8.2.2 A minimum of fifty (50) percent of the total volume of water required to attenuate the peak discharge of the facility in excess of the pollution abatement volume must be evacuated within 24-hours. The remaining fifty (50) percent must be evacuated within an additional seventy-two (72) hours.

12.8.2.3 The outflow structure shall be designed to skim floating debris, oil, and grease from an elevation six (6) inches below elevation of inflow into the structure to an elevation of six (6) inches above the design high water level of the pond and shall cover all directions of inflow to the outfall structure. The design of this control system shall make adequate provision to minimize erosion.

12.8.3 Design Criteria Where a Positive Outfall is Not Available

When a positive outfall is not available or discharge into a lake without a positive outfall is proposed, the pond design shall retain the one-hundred (100) year frequency/twenty-four (24) hour duration storm event. The pond shall be designed without using infiltration during the storm event. The pond shall be designed to completely evacuate a one-hundred (100) year frequency/twenty-four (24)-hour duration storm by natural seepage or positive bleed down within fourteen (14) days. Final design seepage rates will be determined by a geotechnical engineer. All necessary calculations to support the above shall be submitted to the Public Works Director.

12.8.4 Design criteria for offsite drainage

Offsite areas which drain to or across a site proposed for development must be accommodated in the stormwater management plans for the development. The stormwater management system for the development must be capable of conveying existing offsite flows through or around the development. The estimation of the offsite flows must be done separately from the estimation of onsite post development flows (i.e., separate offsite and onsite hydrographs must be computed due to the typically significant differences in land use characteristics).

12.9 OPEN DRAINAGE FACILITIES

12.9.1 Right-of-Way and Easement

- 12.9.1.1 Outfall ditches and canals shall have sufficient right of way for each facility plus an unobstructed maintenance berm on one (1) or both sides.
- 12.9.1.2 Ponds shall have sufficient area to allow for installation plus an unobstructed maintenance berm around the perimeter of the pond.

12.9.2 Maintenance Berms

The minimum requirement for maintenance berms is as follows:

<u>Ditch or Canal Top Width</u>

Minimum Maintenance

Berm Required

Less than 16 feet 20 feet on one side Greater than 16 feet 20 feet both sides

Ponds Ponds

With fencing Without fencing

20 feet around pond perimeter 5 feet around pond perimeter

12.9.3 Grading

Areas adjacent to open drainage ways and ponds shall be graded to preclude the entrance of stormwater except to planned locations. Parcels or lots adjacent to canals shall not be pitched so that runoff from the site enters the canal directly.

12.9.4 Side Slopes

The maximum side slopes for open drainage facilities shall be as follows:

Open Drainageways	Maximum Side Slopes (Horizontal/Vertical Ratio)
Less than or equal to four (4) feet deep	3:1
Over four (4) feet deep	2:1
Ponds	
With fencing six (6) feet high	Greater than 4:1
Without fencing	4:1

Bottom Width

The minimum bottom width for ponds and open drainage ways shall be four (4) feet.

12.9.5 Tailwater

All stormwater ponds shall be designed taking into consideration the tailwater of the receiving facility. In the case where the detention pond discharges to a canal or other water body, the following sources of information may be utilized to determine and acceptable tailwater for routing flows from the pond:

- 12.9.5.1 Studies and reports approved by the City with stage-time-discharge data for canal or waterways to be utilized.
- 12.9.5.2 Where detailed stage-time-discharge information is not available, the Public Works Director may allow the following:
 - a. The use of FEMA floodplain information.
 - b. A normal depth based on the cross-sectional data of the receiving body.
 - c. An average of the elevation of the existing water level and the elevation of the high water mark on the canal or receiving water body.
 - d. Two (2) feet above the established conservation line.
 - e. A detailed drainage study.

12.9.6 Erosion Protection

Open drainage facilities shall be protected from erosion as follows:

Side slopes and berms Bottom

Sod Grass and mulch

12.9.7 Fencing

Open drainage facilities shall be fenced as follows:

Ponds, if required, six foot black vinyl chain link along right of way around perimeter, including maintenance berms.

Canals: Six-foot black vinyl chain link along canal easements or right of way where lots abut canals.

12.9.8 Berms Constructed of Fill

Where berms are proposed, the design shall be certified by the geotechnical engineer. The geotechnical engineer shall also certify that construction has been completed as designed.

12.10 HYDRAULIC DESIGN CRITERIA

12.10.1 Design Storm Frequency

The design storm frequency to be utilized for the design of pavement drainage shall set the hydraulic gradient line at six (6) inches below gutter for a ten (10) year frequency storm.

12.10.2 Runoff Determination

The peak rates of runoff for which the pavement drainage system must be designed shall be determined by the rational method. The time of concentration, individual drainage areas and rainfall intensity amounts shall be submitted as part of the drainage plans. A separate Rational Runoff Coefficient (C) shall be determined for the specific contributing area to each inlet/catch basin within the proposed storm sewer system. A composite C value shall be computed for each contributing area based on an individual C value of 0.9 for the estimated impervious portion of the actual area and an individual C value of 0.2 for the remaining previous (grassed) portion of the actual area.

12.10.3 Stormwater Spread into Traveled Lane

Inlets shall be located at all low points, intersections and along continuous grades to prevent the spread of water from exceeding tolerable limits. The acceptable tolerable limits for roadways is defined as approximately one-half the traveled lane width.

12.10.4 Maximum Inlet Interception Rates

Bypass flow is limited to a maximum of one (1) cfs. Off-site flows from impervious areas of more than one-half (0.5) acre shall be intercepted prior to the right-of-way line. No part of an inlet structure shall be located within an intersection curb radius or in front of the access to the retention pond.

12.10.5 Low Point Inlets

All inlets at low points (sumps) shall be designed to intercept one hundred (100) percent of the design flow without exceeding the allowable spread of water onto the traveled lanes as defined above.

12.11 STORM SEWER DESIGN

12.11.1 Design Discharges

Storm sewer system design is to be based upon a 10-year frequency event and shall be designed to handle the flows from the contributory area within the proposed subdivision.

12.11.2 Minimum Pipe Size

The minimum size of pipe to be used in storm sewer systems is fifteen (15) inches. Designs shall be based upon six (6)-inch increments in sizes above eighteen (18) inches.

12.11.3 Pipe Grade

All storm sewers shall be designed and constructed to produce a minimum velocity of two and one-half feet per second (fps) when flowing full. No storm sewer system or portion thereof will be designed to produce velocities in excess of twenty (20) fps for reinforced concrete pipe or 10 fps for metal pipe, and these maximums shall only be used when these outlet ends have sufficient erosion protection and/or energy dissipates.

12.11.4 Maximum Lengths of Pipe

The following maximum runs of pipe shall be used when spacing access structures of any type.

Pipe Size (inches)	Maximum (feet)	
15	200	
18	300	
24 to 36	400	
42 and larger	500	

12.11.5 Design Tailwater

All storm sewer systems shall be designed taking into consideration the tailwater of the receiving facility. In the case where the detention pond is the receiving facility, the design tailwater level can be estimated from the information generated by routing through the pond the hydrograph resulting from a ten (10)-year frequency storm of duration equal to that used in designing the pond. The design tailwater level can be assumed to be the ten (10)-year pond level corresponding to the time at which peak inflow occurs from the storm sewer into the pond. In lieu of the above detailed analysis, a simpler design tailwater estimated can be obtained by averaging the established twenty-five (25)-year design high water elevation for the pond and the pond bottom elevation for "dry bottom" ponds or the normal water elevation for "wet bottom" ponds.

12.11.6 Hydraulic Gradient Line Computations

The hydraulic gradient line for the storm sewer system shall be computed taking into consideration the design tailwater on the system and the energy losses associated with entrance into and exit from the system, friction through the system, and turbulence n the individual manholes/catch-basins/junction boxes within the system. The energy losses associated with the turbulence in the individual manholes are minor for an open channel or gravity storm sewer system and can typically be overcome by adjusting (increasing) the upstream pipe invert elevations in a manhole by a small amount. However, the energy losses associated with the turbulence in the individual manholes can be significant for a pressure or surcharged storm sewer system and must be accounted for in establishing a reasonable hydraulic gradient line.

12.12 CULVERT DESIGN

12.12.1 Minimum Pipe Size

The minimum sizes of pipes to be used for culvert installations under roadways shall be eighteen (18) inches. The minimum size of pipes to be used for driveway crossings shall be fifteen (15) inches. Mitered end sections shall be provided on all pipes.

12.12.2 Maximum Pipe Grade

The maximum slope allowable shall be a slope that produces ten (10) fps velocity within the culvert barrel. Erosion protection and/or energy dissipates may be required to properly control entrance and outlet velocities.

12.12.3 Maximum Length of Culverts

The maximum length of culvert conveyance structure without access shall be as allowed in Paragraph 1.11.3

12.12.4 Design Tailwater

All culvert installations shall be designed taking into consideration the tailwater of the receiving facility.

12.12.5 Allowable Headwater

The allowable headwater for a culvert installation should be set by the designer for an economical installation. When endwalls are used, the headwater should not exceed the top of the endwall at the entrance. If the tope of the endwall is inundated, special protection of the roadway embankment and/or ditch slope may be necessary for erosion protection.

SECTION 13 ROADS AND STREETS – TECHNICAL REQUIREMENTS

13.1 STREETS AND ROADWAYS

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13.2 PAVEMENT MARKING/SIGNING/SIGNALIZATION

- 13.2.1 Pavement Markings General
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13.3 BIKE PATHS/LANES

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- 13.4.1 Design Criteria
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SECTIONS 13 ROADS AND STREETS - TECHNICAL REQUIREMENTS

13.1 STREETS AND ROADWAYS

13.1.1 Design Criteria

13.1.1.1 Design Standards

As a minimum, roads and/or streets and related facilities shall be designed in accordance with the latest editions of the "Manual of Minimum Standards for Design, Construction and Maintenance for Streets & Highways" (Green Book), "Flexible Pavement Design Manual", "Standard Specifications for Road and Bridge Construction," "Roadway and Traffic Design Standards" and the Utility Accommodation Guide, as published by the State of Florida Department of Transportation, except as modified herein.

13.1.2 Construction Criteria

Construction materials and methods shall meet the requirements of the latest edition of the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction" and supplements, except as modified herein, and other provisions of this document.

13.1.2.1 Temporary Facilities

Temporary facilities, unrelated to any ongoing construction in a right-of-way, and intended to provide an essential service for a period of time not to exceed one year, may be constructed in a right-of-way, contingent upon Public Works Department approval of project plans and specifications, and issuance of a Public Works Department Right-of-Way Permit. There will be no relaxation of safety requirements, but lighter duty construction will be allowed, where public interests will not suffer.

In cases where temporary facilities must be constructed to provide or maintain an essential feature around portions of a public right-of-way for public safety or convenience during construction, such temporary facility must be clearly drawn in sufficient detail on standard size drafting sheets, and submitted to the Public Works Department for review and approval prior to implementation.

13.1.3 Typical Sections

Sketches of proposed typical sections, indicating design speed, shall be submitted to the Public Works Department for approval prior to beginning the preparation of plans, and shall show or note all existing conditions or facilities that might influence a proper engineering evaluation of the proposed project.

13.1.4 Safety Criteria

Minimum safety criteria for design of roads and streets in the City of Groveland shall be in accordance with FDOT requirements.

13.1.5 Roadways Adjacent and Parallel to Waterways

The following policy is to be implemented in the design of all roadway construction involving lakes and canals when it is necessary for such waterways to exist adjacent and parallel to the roadway.

For purposes of the policy, a canal is considered to be an open ditch with the side slope adjacent to the roadway 4:1 or steeper and/or with a seasonal water depth in excess of three feet for extended periods of time (24 hours or more). When the roadway slope and the canal side slope adjacent to the roadway is 6:1 or flatter, the minimum distance to the canal may be measured from the edge of the through travel lane to the water surface at the point where the depth is in excess of three feet for 24 hours or more. The berm between the roadway front slope and canal slope is not required for this condition.

13.1.5.1 Minimum Distance to Lakes/Canals

The distance from the outside edge of the through travel lane to the top of the lake/canal side slope nearest the road, will be no less than 60 feet for highways with design speeds of 50 miles per hour (MPH) or greater. For highways with design speeds less than 50 MPH, this minimum distance may be reduced to 50 feet for rural highways or 40 feet for urban (curb and gutter) highways. When a new lake/canal or roadway alignment is required, at less than the ultimate cross-section, distances greater than these above should be provided, if possible, to accommodate possible future improvements to roadway (widening, etc.).

13.1.5.2 Roadways on Fill Sections

A flat berm (maximum 10:1 slope) of width no less than 20 feet will be provided between the toe of the roadway front slope and the top of the lake/canal side slope nearest the roadway. This minimum berm width applies to all types of highways, both rural and urban (curb and gutter) construction, regardless of the distance from roadway front slope to the top of the lake/canal side slope.

13.1.5.3 Roadways in Cut Sections or with Adjacent Ditches A minimum of 15 feet will be provided between the inside edge of the roadside ditch bottom and the top of the lake/canal side slope nearest the road.

13.1.5.4 Installation of Protection

Installation of guardrail, or other approved protective devices, <u>is</u> recommended throughout all areas where it is impracticable (by the determination of the Public Works Director) to meet the above minimum criteria. For canals located on the outside of curves sharper than 2 degrees, greater offset widths or construction of guardrail should be considered.

When guardrail is required for canal protection, it will normally be placed at or near the edge of the clear recovery area. The distance from the outside edge of the shoulder to the face of guardrail should, in all cases, be greater than 12 feet when guardrail is not constructed at the edge of the shoulder. The roadway front slope back of guardrail may be steepened to 2:1.

13.1.5.5 Guardrail

Guardrail materials and installation shall be in accordance with "Florida Department of Transportation Roadway and Traffic Design Standards, "Index No 400.

13.1.5.6 Handrail

Handrail shall be painted dark green. Materials and installation shall be in accordance with "Florida Department of Transportation Roadway and Traffic Design Standards, "Index No 520.

13.1.6 Flexible Pavement Design

Flexible pavement design shall be in accordance with the criteria established in the "FDOT Flexible Pavement Design Manual for New Construction and Pavement Rehabilitation", latest edition. Road design by this method requires calculation of a structural number, which is obtained by multiplying the FDOT (AASHTO) structural coefficient by the thickness of each layer of material, then adding the resultants in accordance with the FDOT Flexible Pavement Design Manual: $(SN = a_1D_1 + a_2D_2 + ... a_nD_n)$. However, in no case shall the thickness of any layer be less than the minimum outlined in the following paragraphs.

Any deviations or deficiencies from the design which may occur in the construction of the road shall be corrected by construction or re-construction to obtain the minimum structural number (i.e.: additional asphaltic concrete surface course, etc.), equivalent to the design structural number or the structural number calculated from using the minimum layer depths contained in these specifications, whichever is greater, and only as approved by the Public Works Director after submittal of the measurements of the actual constructed road section, along with calculations of the structural number of the proposed remedial work.

13.1.6.1 Stabilized Subgrade

The entire width of the right-of-way shall be demucked before construction of the roadbed begins, to a minimum depth of 12 inches. No material of FDOT Class A-5, A-7 or A-8 will be allowed. All material

supporting the roadway and shoulders shall have a minimum LBR of 40, unless otherwise approved by the Public Works Director, and alternate materials/layer depths are provided to obtain the required minimum structural number. The subgrade shall be compacted to 98% of maximum dry density as determined by AASHTO T-180 (Modified Proctor), to the below listed minimum depths. Stabilization and subgrade treatment materials and construction shall be in compliance with FDOT Standard Specifications for Road and Bridge Construction, latest edition.

Residential	Minimum Depth (Inches)
Arterial Collector Local	16 12 12
<u>Industrial</u>	12
Commercial	12

Testing for the subgrade bearing capacity and compaction shall be conducted at intervals no greater than five hundred feet and shall be staggered to the left, right and on the centerline of the roadway. There shall also be no less than one test on each street. Tests shall be reviewed by the Engineer of Record.

13.1.6.2 Base Course

Subject to the approval of the Public Works Department, base material may be either soil cement, crushed concrete or limerock. Where a new base is to be constructed over an existing roadway, the existing pavement shall be removed. The material may be re-used in the bottom 4 inches of the new base after crushing, so as to pass through a 3-1/2 inch sieve. All base shall be primed, as required elsewhere in these specifications. Minimum depth of base shall be as follows:

Residential	Minimum Depth (Inches)
Arterial Collector Local	12 8 8
<u>Industrial</u>	10
Commercial	8

13.1.6.3 Soil Cement

Soil cement base, where approved by the Public Works Department shall be installed with materials and constructed in accordance with

FDOT Standard Specifications for Road and Bridge Construction, latest edition. Soil cement shall have a minimum seven day compressive strength of 300 pounds per square inch (psi) for mixed in place base or 500 psi for plant mix or when intended for use as a layer coefficient of 0.20 for flexible pavement base. The design mix shall be prepared by a testing laboratory and submitted to the Public Works Department after review by the Engineer of Record.

Soil cement shall be compacted to a density of not less than 98% of maximum dry density as determined by AASHTO T-134 under all paved areas within the traveled roadway. Outside the traveled roadway, compaction shall be not less than 95% as determined by AASHTO T-134. Soil cement base shall have test cores taken after seven days to verify thickness and compressive strength. Average core thickness shall not deviate from the design thickness by more than one inch in excess, nor more than one half inch deficiency. Cores shall be taken at locations of anticipated high water table and other locations deemed necessary by the Engineer of Record. Soil cement base shall be cured as long as practicable prior to paving, but no less than a minimum of fourteen days, unless a geotextile membrane is utilized, in which case a minimum cure time of seven days is required.

13.1.6.4 Limerock

Limerock used in base construction shall have an average Limerock Bearing Ratio (LBR) of not less than 100. Materials and construction shall be in accordance with FDOT Standard Specifications for Road and Bridge Construction, latest edition.

Limerock base shall be compacted to a density of not less than 98% of maximum dry density as determined by AASHTO T-180 (Modified Proctor) under all paved areas within the traveled roadway. Outside the traveled roadway, compaction shall be not less than 95% as determined by AASHTO T-180.

13.1.6.5 Surface Course

Surface courses for flexible pavements shall be Type S asphaltic concrete, unless otherwise approved by the City. Prime coats or tack coats shall be applied as outlined elsewhere in this document, prior to applying the surface course. Asphaltic concrete shall comply with the FDOT Standard Specifications for Road and Bridge Construction, latest edition, for materials and construction. Design of the mix shall be prepared by a testing laboratory. The design mix shall be submitted to the Public Works Department after review by the Engineer of Record. Plant mix certification shall be submitted to the Public Works Department after review by the Engineer of Record for inclusion with record drawings. Cores shall be taken at intervals of not more than 500 feet, but at least one core shall be taken on every street. Reports of test cores shall be forwarded to the Public Works Department after review by the Engineer of Record for inclusion with the record

drawings. Visual inspection of asphaltic concrete thickness at the time of lay down may be substituted, only if approved by the Public Works Director. Minimum thickness of surface course shall be as follows:

Residential

Minimum Depth (Inches)

Arterial Collector Local	2-1/4 2 1-1/2
<u>Industrial</u>	2
Commercial	2

13.1.7 Portland Cement Concrete Pavement Design

Portland cement concrete pavement may be constructed where indicated on City approved construction plans. Lines, grades, thickness and typical cross sections shall be shown on the plans. Design shall be in accordance with the FDOT "Standard Specifications for Road and Bridge Construction," latest edition, and recommendations of the Portland Cement Association. Design mix shall be prepared by a testing laboratory, and shall be reviewed by the Engineer of Record prior to forwarding to the Public Works Department for inclusion with record drawings. Concrete pavement shall be designed for a minimum 28 day compressive strength of 3000 psi. Concrete cylinders shall be made for every 50 cubic yards, but no less frequent than one set for each day's placement. Construction, including placement, jointing and curing shall be carried out in accordance with the FDOT standard specifications. Minimum thickness of concrete pavement shall be as follows:

Residential	Minimum Concrete Thickness
	(Inches)
Arterial	7
Collector	6
Local	6
<u>Industrial</u>	7
Commercial	6

13.1.8 Shoulders

All shoulders shall have an eight feet width stabilized to an LBR value of at least 40. The minimum depth of the stabilized shoulder shall be eight inches. All shoulders shall be compacted to 98% of maximum density as determined by AASHTO T-180.

13.1.9 Curb/Gutter

Curb and gutter shall be constructed of portland cement concrete and shall conform to the FDOT Standard Index for the type selected. Sections shall be shown on the construction plans and are subject to the approval of the Public Works Department. Materials and construction shall be in compliance with the FDOT Standard Specifications.

All curbs and gutters shall be installed on a foundation of stabilized subgrade having a minimum LBR ratio of 40, which has been compacted to a minimum density of 98% of maximum density as determined by AASHTO T-180 and extending 6 inches (min.) beyond the edges of the concrete.

13.1.10 Medians

Medians where required, shall be constructed of portland cement, patterned concrete, or with brick pavers, with planting beds, landscaping and irrigation systems, in accordance with the Public Works Manual, or as modified by any access management agreements between the City of Groveland and FDOT or Lake County. Plans and sections, along with materials, colors and patterns of the concrete, shall be shown on construction plans and submitted to the City for approval by the Public Works Director.

13.1.11Swales

Bottoms of swales, measured from top of turf, shall be at least 4 inches below the edge of adjoining pavement, and shall be adequately sized to carry the volume of runoff when designed in accordance with approved storm drainage criteria.

13.1.12 Drainage

All drainage work within public right-of-ways shall be in accordance with City of Groveland Public Works Department requirements, and State of Florida Department of Transportation "Utility Accommodation Guide", except as modified herein, and in elsewhere in this document.

- 13.1.12.1 Unless otherwise approved by the Public Works Director, drainage pipe installations under roadways, in present or planned paved areas shall be of reinforced concrete, conforming to ASTM Standard C-301. The minimum size pipe to be used shall be 15 inches diameter. Mitered or flared end sections shall be provided, designed and constructed in accordance with the appropriate FDOT Standard Index.
- 13.1.12.2 Drainage pipe for unpaved areas or for crossing under roadways may be of reinforced concrete, or other materials as approved by the Public Works Department.
- 13.1.12.3 All drainage pipe in the public right-of-way shall have a minimum of 30 inches of cover, unless otherwise approved by the Public Works Director.

- 13.1.12.4 No swaled driveways will be permitted within City right-of-ways. Driveways shall be provided with drainage pipe, constructed with mitred end sections or concrete headwalls.
- 13.1.12.5 Drainage manholes shall be not less than four feet inside dimension between opposing walls and shall meet the requirements of ASTM Standard C-478. Walls shall be not less than 6 inches thick.
- 13.1.12.6 All other drainage structures including inlets, endwalls, culverts, flumes, etc. shall be provided, designed and constructed in accordance with the appropriate FDOT standard index.
- 13.1.12.7 Fencing for retention ponds shall be black, vinyl coated, chain link, except as otherwise required by the City's Land Development Code.

13.1.13Sidewalks

Sidewalks shall be portland cement concrete, a minimum of 4 inches thick, and 5 feet wide, minimum. Where extending across driveways, sidewalks shall have a minimum thickness of 6 inches. Sawed contraction joints shall be a minimum of 1-1/2 inches deep. Expansion joints shall be provided between the sidewalk and curbing, driveways and all other fixed objects. Sidewalks shall have a transverse slope of 1/4" per foot toward the swale or gutter and shall be given a transverse broom finish. Handicapped ramps shall be installed wherever sidewalks meet upright curbs, and as otherwise required by the Americans With Disabilities Act (ADA). Any necessary obstruction shall be placed so as to maintain the maximum clear width. Sidewalks shall be maintained by the owners of the abutting properties. Alternate materials and methods of construction may be considered by the Public Works Department for temporary installations. Special surface treatments such as pavers, tile, etc., may be considered by the Public Works Department upon request of the Developer or Engineer of Record.

Sidewalks shall be constructed on at least one side of internal subdivisions. Where sidewalk is to be constructed on only one side of the street, the City will designate the side. At intersections with existing streets, sidewalks shall be extended to the right of way at rural roadway sections, or to the back of curb of existing roadways at urban sections. Curb cuts and handicap ramps shall be provided when connecting to existing urban sections.

In situations where improvements are planned for existing roadways which would result in damage or require removal of sidewalks; or where it can be demonstrated that significant damage is likely to occur due to subsequent building construction on the project for which the sidewalk is to be installed, at the discretion of and with the prior approval of the Public Works Director, installation may be deferred, subject to the Developer posting with the City, a "Sidewalk Performance Bond" in a format acceptable to the City.

13.1.14Grassing/Seeding/Mulching/Sodding/Fertilizing

Whenever a suitable length of roadway or adjacent areas have been graded, they shall be grassed and mulched across the full right-of-way, outside the limits of pavement, at the earliest practical time, and in all cases, before the final paving course. Except for areas adjacent to established turf, grass seed may be used, unless otherwise agreed between the Developer and the Public Works Department. In the areas adjacent to established turf, sod of the same type of grass shall be installed. In areas where erosion and/or growing conditions may be a problem and for a minimum of 2 feet around all structures and the back of all curbs, solid sod of the same type as the adjacent turf areas shall also be installed. The Developer shall maintain the grass, including watering and mowing until a good stand of grass is established and the project is accepted. It is the intent of this document that areas to be grassed have a growing stand of grass for a period of at least one year after completion/acceptance of the project. All grassed areas shall be mowed at least once prior to acceptance of the project.

13.1.15Restoration

The entire work area utilized for the performance of any permitted work shall be restored by the permittee as described elsewhere.

13.1.16Record Drawings & Certifications

One reproducible set, two blue line copies and one electronic copy, in a format acceptable to the City, of complete record drawings ("as-builts") shall be submitted to the Public Works Department prior to final acceptance by the City. Each individual sheet shall be clearly marked "Record Drawing", dated and signed and sealed by the Engineer of Record. These drawings must show all changes from the approved construction plans, including, but not limited to invert elevations, grade changes, as well as finished base elevations and offsets at centerline, edge of median and edge of pavement, plus elevations of bottom of swale or flow line of gutter, top of curb and right-of-way line, at high and low points, intersections and breaks in grade. Elevations shall be verified and shown at intervals not to exceed 300 feet measured along the profile grade line. All high point and low point elevations shall be shown.

Compaction must be verified by an independent certified engineering testing laboratory by making field density tests of each layer of compacted material at prescribed intervals before the succeeding layer is placed. Test reports and record drawings must be submitted to the Public Works Department before final acceptance.

13.1.17 Final Inspection and Acceptance

After construction is completed and all certifications, record drawings and other required documents have been submitted to, and accepted by, the Public Works Department, but before the one-year bonded maintenance period begins, the permittee shall request a final inspection of the project. The Public Works Department, the Engineer of Record and all other interested parties shall jointly perform such inspections as necessary for the Public Works Department to determine the acceptability of the project for maintenance by the City. Following the inspection, any noted defects shall be corrected by the permittee, after which

the Public Works Department and other maintaining agencies, will issue a notice of acceptance. This will mark the start of the one-year warrantee period.

13.2 PAVEMENT MARKING/SIGNING/SIGNALIZATION

13.2.1 Pavement Markings - General

The design and construction of pavement marking systems shall be in accordance with the following standards:

U.S. Department of Transportation, Federal Highway Administration - Manual on Uniform Traffic Control Devices for Streets and Highways, latest edition.

Florida DOT - Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways, latest edition.

Florida DOT - Standard Specifications for Road and Bridge Construction, latest edition.

Florida DOT - Roadway and Traffic Design Standards.

American Association of State Highway and Transportation Officials (AASHTO) - A Policy on Geometric Design of Highways and Streets.

13.2.1.1 Pavement Marking Plan

Pavement marking and signing plans shall be submitted to the Public Works Department for review and approval as part of the construction plans for development where street or road construction is included. These plans shall show all new markings including tie-ins to existing markings. Removals of existing markings shall also be shown. Materials shall be specified and shall be in compliance with FDOT Standard Specifications. The location of raised reflective pavement markers shall be identified.

13.2.1.2 Permanent Pavement Markings

Permanent pavement markings shall be thermoplastic and shall meet the requirements of FDOT Standard Specifications for thermoplastic traffic stripes and markings. Paint shall not be used for permanent pavement markings unless prior approval has been granted by the Public Works Director.

13.2.1.3 Temporary Pavement Markings

Temporary pavement markings may be used during intermediate phases of road construction or where overlayment or further construction of the road is imminent (generally within 2 years). Temporary markings shall consist of paint meeting the requirements of FDOT Standard Specifications. Thermoplastic or inlaid preformed

plastic material shall not be used except with the prior approval of the Public Works Director.

13.2.1.4 Removal of Old Pavement Markings

Old pavement markings shall be covered by a pavement overlay prior to installing new markings. Old markings can be removed by grinding, provided residual scarring does not occur which will interfere with the new markings. Old markings can be painted over with black paint as a temporary measure only.

13.2.1.5 Construction/Resurfacing

Pavement markings (either permanent or temporary) shall be installed on the project as soon as practicable following paving. In the event a road is placed in service, the temporary or permanent pavement striping shall be applied by the end of each day's operation unless precluded by inclement weather, in which case it shall be striped during the next daylight period. Any road placed in service without striping shall have the traffic lanes delineated by temporary tape or markers, in accordance with Section 6D of the "United States Department of Transportation Manual of Uniform Traffic Control Devices for Streets and Highways", latest edition.

13.2.2 Signs - General

Traffic signs shall be installed and paid for by the developer. The City will provide the maintenance for signs, which are the City standard. For non-standard signs, the developer or appropriate homeowners association shall pay for maintenance. The developer or the appropriate homeowners association shall also pay the costs for the subsequent conversion of non-standard signs to the City standard.

Design and construction of traffic signs shall be in accordance with the "FDOT Standard Specifications" and "FDOT Roadway and Traffic Design standards Manual on Uniform Traffic Control Devices".

13.2.2.1 Signing Plans

Signing plans shall be submitted, with paving marking plans, to the Public Works Department for review, as part of the construction plans for development where street or road construction is included. These plans shall show all new signs and all existing signs, which are designated to remain.

13.2.2.2 Materials

All "STOP", "YIELD", "DO NOT ENTER", and "WRONG WAY" signs and street name signs shall be fabricated entirely with high intensity

reflective sheeting. Other signs shall be fabricated using engineering grade materials.

13.2.2.3 Maintenance of Signs During Construction

"STOP" and "YIELD" signs shall be maintained during construction. All temporary signs shall conform to the same specifications as permanent signs.

13.2.2.4 Design of Supports

Shop drawings and quantities for overhead sign structures, special designs for ground sign structures, and large guide sign panels, shall be submitted to the Department or Public Works after review by the Engineer of Record.

Minimum vertical clearances for overhead signs shall be as detailed in Florida Department of Transportation's "Traffic Operations Standards".

13.2.3 Traffic signals

13.2.3.1 Materials

All materials and workmanship shall meet the requirements of the "USDOT Manual on Uniform Traffic Control Devices for Streets and Highways", "Institute of Transportation Engineers", the "National Electrical Code", "Underwriters Laboratories, Inc.", "Industrial Control Standards of National Electrical Manufacturers Association", "International Municipal Signal Association" and applicable FDOT standards and specifications.

13.2.3.2 Signal Poles

Except where otherwise approved by the City of Groveland, traffic signals shall be mounted on mast arms meeting he requirements of FDOT Series 1700 and shall be dark green in color.

13.2.3.3 Pole Foundations

Foundation installations shall be back-filled and compacted to a firm, stable condition equal to or greater than that of the surrounding soil. Where applicable, the pole base shall be finished flush with the adjoining sidewalk so as to allow an obstruction free walking surface.

13.2.3.4 Pole Locations

Poles, generally, shall be located at the right-of-way lines (back of the sidewalk).

13.2.3.5 Pole Position Adjustments

Pole positions and conduit routing may be adjusted as approved by the Public Works Department to prevent conflicts with utility and drainage structures not indicated on plans.

13.2.3.6 Minimum Pole Heights

All signal poles shall have a minimum height adequate to provide a 17 foot Low Point Center for bottom of signal head, and not more than 19 feet.

13.2.3.7 Grounding

All poles, controllers, detector cabinets and pull boxes, and other elements of the installation shall be grounded by installing either a ground rod assembly or a ground rod array.

13.2.3.9 Signal Heads

A minimum of two signal heads for each approach for vehicular traffic shall be provided. Pedestrian signals, push buttons, and signs shall be provided on all corners. Vehicular signals shall be installed with drop pipes and disconnect hangers.

13.2.3.10 Controller and BC4T Cabinet

All "T" intersections shall have a four phase full actuated controller in a BC4T cabinet and all 4-way intersections shall have an eight-phase full actuated controller in a BC4T cabinet, unless otherwise specified by the Public Works Department.

13.2.3.11 Vehicle Inductive Loop Detectors

Vehicle inductive loop detectors shall be 5 feet wide by 40 feet long, with 10 feet extending in front of STOP bar in a quadrapole pattern of 1-2-1 winding, unless otherwise specified by the Public Works Department.

13.2.3.12 Shop Drawings

Manufacturer's descriptive literature and technical data which fully describes the types of signal equipment proposed for use, shall be

forwarded to the Public Works Department after review by the Engineer of Record.

13.2.3.13 Record Drawings

Record drawings shall be submitted for all traffic control devices, indicating deviations from the approved construction plans. Drawings shall be submitted to the Public Works Department after review, dating, signing and sealing by the Engineer of Record.

13.3. BIKE PATHS/LANES

13.3.1 Design Criteria

Design of bike paths/bike lanes shall comply with the requirements/guidelines of the Federal Highway Administration, the Florida Department of Transportation, and the "Manual on Uniform Traffic Control Devices" (MUTCD). Alternate materials and methods of construction will be considered for temporary installations. Striping and signage shall be as set forth in the MUTCD and FDOT Standard Specifications. Paths shall be painted with paint meeting the requirements of FDOT Standard Specifications for traffic paint or fast dry traffic paint. Paint color shall be approved by the City of Groveland.

13.4. BRIDGES AND BOX CULVERTS

13.4.1 Design Criteria

Design of bridges and box culverts associated with City of Groveland streets and roads shall be carried out by a Florida Licensed structural engineer qualified to provide professional engineering services in this area of expertise. Bridges and box culverts shall be designed in accordance with the requirements/guidelines of the Federal Highway Administration, the Florida Department of Transportation and other applicable codes and standards. The structures shall be designed and constructed to be consistent with the streets to which these structures are connecting, in terms of the number of lane widths and street section and traffic loadings. These structures shall carry pedestrian and bike travel, if these features are provided by the adjoined streets/roads. Appropriate safety measures, such as handrails, guard rails, etc. shall be provided. Sidewalks shall be elevated six inches above the bridge/box culvert driving surface by use of an upright (Type D or Type F) curb.

Appropriate and complete soils investigations shall be conducted prior to the design. The information shall be evaluated and the foundations shall be designed by a Florida Licensed structural and/or geotechnical engineer qualified to perform these services.

13.4.2 Construction

Pre-cast, pre-fabricated or pre-engineered structures may be used, if the design is signed and sealed by a qualified Florida licensed engineer. Construction of such

structures shall be in strict compliance with the manufacturer's recommendations and in compliance with all applicable codes and standards.

Conventional construction shall be done only by qualified construction contractors with sufficient experience in similar construction, as determined by the City.

13.4.3 Utilities Crossings

The use of bridges and box culverts for supporting pipe and utilities crossings is discouraged. However, the City may accept these on a case by case basis, if the Engineer of Record provides sufficient design and supporting information to satisfy the Public Works Director as to the need, appropriateness and safety of said crossings. Proper pipe supports and protection of the pipe and/or utility shall be provided, without impeding of the stream flow.

SECTION 14 PAVING – GENERAL REQUIRMENTS

14.2	FEES		
14.3	PLANS AND SPECIFICATIONS		
14.4	CONFLICT MANHOLES		
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14.1 PERMITS

SECTION 14 PAVING - GENERAL REQUIREMENTS

14.1 PERMITS

Permits for construction, modification or maintenance of roadways, sidewalks, drainage or related facilities shall be granted only after the following requirements have been met:

- 14.1.1 Paving and drainage plans must have been reviewed and be deemed complete by the Public Works Department prior to approval.
- 14.1.2 All required permits have been obtained from the St. John's River Water Management District, Florida Department of Environmental Protection, Florida Department of Transportation, U. S. Environmental Protection Agency, U.S. Corps of Engineers and any/all other agencies having permitting jurisdiction over the proposed work. Approval or acceptance by the City of Groveland of the proposed facilities does not imply acceptance of any other agency.
- 14.1.3 Other applicable provisions of this document.

14.2 FEES

- 14.2.1 Fees will be charged in accordance with the City of Groveland fee schedule currently in effect.
- 14.2.2 No security shall be required for driveway connections to paved roadways

14.3 PLANS AND SPECIFICATIONS

- 14.3.1 All plans shall be submitted on white prints with blue or black lines. In addition to the proposed project they shall show all existing facilities as well as all other planned facilities in sufficient detail to permit assessment of the compatibility of the proposed work and the existing systems.
- 14.3.2 Plans must be submitted on 24" x 36" sheets, except that for small projects plans may be submitted on legal size paper, provided that scale requirements are met and only one sheet is required.
- 14.3.3 Any general area layout shall be prepared at a scale of 300 feet or less to the inch. Detailed plans shall be prepared at a scale of 20 feet or less to the inch. (40 feet or less for subdivisions). Design drawings for arterial and collector roads shall include both plans and profiles. Design drawings for local roads need not include roadway profiles. When profiles are drawn, they shall be to the same horizontal scale as the plan.
- 14.3.4 The names and boundaries of all abutting subdivisions shall be shown, giving the plat book and page number of the recordation.
- 14.3.5 Areas not platted shall be shown as acreage, and the Section, Township and Range shall be noted.

- 14.3.6 Dimensions of right-of-ways widths shall be indicated.
- 14.3.7 All plans shall show suitable legends.
- 14.3.8 New pavement shall be indicated by notes and/or light shading.
- 14.3.9 Cross-sections and/or typical sections of proposed road and drainage construction, shall show dimensions, materials and purposes of all existing (to remain) facilities as well as all proposed facilities within the right-of-way.
- 14.3.10The public roadways proposed in the plans shall be designed in accordance with the "Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways, State of Florida," unless otherwise approved by the Public Works Director.

14.4 CONFLICT MANHOLES

All conflict manholes must have approval of the appropriate State or County reviewing agencies before being permitted by the Public Works Department, and must be constructed as shown in the Construction Details. This shall apply to field changes as well as conflict structures proposed in the design of the project in question.

14.5 HOT BITUMINOUS MIXTURES

14.5.1 Weather Limitations

- 14.5.1.1 Limitations of Laying Operations: General: The mixture shall be spread only when the surface upon which it is to be laid has been previously prepared, is intact, firm and properly cured, and is dry. Unless otherwise approved by the Public Works Department, no mixture shall be spread that cannot be finished and compacted during daylight hours.
- 14.5.1.2 Temperature: The mixture shall be spread only when the air temperature (the temperature in the shade away from artificial heat) is above 40 degrees F and is not dropping.
- 14.5.1.3 Wind: The mixture shall not be spread when the wind is blowing to such an extent that proper and adequate compaction cannot be maintained or when sand, dust, etc. are being deposited on the surface being paved, to the extent that the bond between layers will be diminished.
- 14.5.2 Preparation of Asphalt Cement: The asphalt cement shall be heated in advance of the mixing operations, to within a range of 270 degrees F to 350 degrees F. Heating within these limits shall be constant and wide fluctuations of temperature during the day's production will not be permitted.

14.5.3 Preparation of Aggregates

14.5.3.1 Stockpiles: Each aggregate component shall be placed in an individual stockpile, which shall be separated from the adjacent stockpiles, either

- by space or by a system of bulkheads. The intermingling of different materials in stockpiles shall be prevented at all times.
- 14.5.3.2 Prevention of segregation: In the event that the method used for stockpiling coarse aggregate results in segregation of the aggregate, stockpiles shall be built up in layers not higher than four feet, with each layer completely in place before the next is started. Stockpiles shall not be formed by depositing material in one place or by forming cones.
- 14.5.3.3 Blending of Aggregates: Blending or proportioning from railroad cars will not be permitted. All aggregates shall be stockpiled prior to blending or placing in the cold hoppers. All aggregates to be blended or proportioned shall be placed in separate bins at the hopper and proportioned by means of securely positioned calibrated gates or other approved devices.
- 14.5.3.4 Mineral Filler: If mineral filler is required in the mix it shall be fed or weighed-in separately from the other aggregates.

14.5.4 Preparation of Mixtures

- 14.5.4.1 Aggregates: The dried aggregates and mineral filler (if required), prepared in the manner previously described, and combined in batches to meet the job mix formula by weighing each separate bin size, shall be conveyed to the empty mixer.
- 14.5.4.2 Bitumen: The hot asphalt cement, accurately measured, shall be introduced into the mixer simultaneously with, or after, the hot aggregates. Mixing shall continue until the mixture is thoroughly uniform, with all particles fully coated.
- 14.5.4.3 Mixing Time: The mixing time shall begin when the measuring devices for both the asphalt and the aggregates indicate that all the material is in the mixer, and shall continue until the material begins to leave the mixing unit. The mixing time will vary in relation to the nature of the aggregates and the capacity of the mixer, but shall in no case be less than 35 seconds.
- 14.5.4.4 Continuous Mixing: The dried aggregate and mineral filler (if required), prepared as specified and proportioned to meet the job mix formula by volumetric measurements, shall be introduced into the mixer in synchronization with the accurate feeding of the hot asphalt cement. The rate of flow of material to the pugmill shall be such that the maintained depth of the mix will not exceed the tips of the paddles when in the upright position. Mixing shall be sufficient to produce a thoroughly and uniformly coated mixture.
- 14.5.4.5 Drum Mixing: The aggregates and mineral filler (if required), prepared or specified and proportioned to meet the job mix formula, shall be introduced into the drum mixer with the accurate feeding of asphalt cement. The rate of flow of material to the drum shall be such that the

- manufacturer's mixing capacity shall not be exceeded. Mixing shall be sufficient to produce a thoroughly and uniformly coated mixture.
- 14.5.4.6 Mixing Temperature: The ingredients of the mix shall be heated and combined in such a manner as to produce a mixture which shall be at a temperature, when discharged from the pugmill or hot storage (surge) bin, within 25 degrees F of the design temperature, and within the temperature limits specified in Section 5.2.
- 14.5.4.7 Contractor's Responsibility for Mixture Requirements: The responsibility for producing a homogeneous mixture, free from excess moisture and with no segregated materials, and meeting all requirements of the specifications for the mixture, including compliance with the design limits, shall lie entirely with the Contractor. These requirements shall also apply to all mixes used from a hot storage or surge bin, both before and after storage. No mix shall be stored overnight.
- 14.5.5 Transportation of the Mixture: The mixture shall be transported in tight vehicles previously cleaned of all foreign material and each load shall be covered. The inside surface of the truck bodies shall be thinly coated with soapy water or an approved emulsion containing not over 5% oil, but no excess of either shall be used. Kerosene, gasoline or similar products shall not be used. After the truck bodies are coated and before any mixture is placed therein, they shall be raised so that all excess liquids will be drained out.

14.5.6 Coating Materials

- 14.5.6.1 Prime Coat: The material used for prime coat shall be cut-back asphalt, Asphalt Grade RC-70 or RC-250, meeting the requirements of AASHTO M81-751, Emulsified Asphalt Grades SS-1 or CSS-1, SS-1H or CSS-1H, diluted in equal proportion with water and meeting the requirements of AASHTO M140-7O, or other types and grades of bituminous material which may be called for in approved plans. The Contractor may select any of the specified bituminous materials for use, unless the approved plans indicate use of a specific material. Types and grades of bituminous material other than those specified above may be allowed if it can be shown that the alternate material will properly perform the function of prime coat material.
- 14.5.6.2 Tack Coat: The material used for tack coat shall be undiluted Emulsified Asphalt Grades RS-1 or RS-2, unless some other specific material is called for by the approved plans. RS-1 and RS-2 shall be heated to a temperature range of between 140 degrees F and 180 degrees F. RS-1 may be modified by the addition of up to 3% naphtha during the winter months to improve handling of the material.
- 14.5.6.3 Tack Coat Required: A tack coat, as specified in 5.6.2, will be required on the following surfaces:

- a. Between hot bituminous base courses and surface courses.
- b. On primed bases which have become excessively dirty and cannot be cleaned.
- c. In areas where the prime coat has cured to the extent that it has lost bonding effect.
- d. On old pavements to be patched or leveled.
- 14.5.6.4 Tack Coat Optional: A tack coat will be required on the following surfaces only when so directed by the Engineer of Record:
 - a. Freshly primed bases.
 - b. Surface treatment.
 - c. Other surfaces shown on the approved plans.

14.5.7 Preparation of Application Surfaces

- 14.5.7.1 Cleaning: Prior to the laying of the mixture, the surface of the base of pavement to be covered shall be cleaned of all loose and deleterious material by the use of power brooms, supplemented by hand brooming as necessary.
- 14.5.7.2 Patching and Leveling Courses: Where a surface course is constructed on an existing pavement or old base which is irregular, and wherever so indicated in the approved plans, the existing surface shall be brought to proper grade and cross section by the application of patching or leveling courses.
- 14.5.7.3 Application Over Surface Treatment: Where a surface course is to be placed over a newly constructed surface treatment, all loose material shall be swept from the paving area and disposed of by the Contractor.
- 14.5.7.4 Coating Surfaces of Contacting Structures: All structures which will be in actual contact with the asphalt mixture, with the exception of the vertical faces of existing pavements and curbs or curb and gutter, shall be provided with a uniform coating of asphalt cement to provide a closely bonded, watertight joint.

14.5.8 Placing Mixture

- 14.5.8.1 Requirements Applicable to All Types:
 - a. Alignment of Edges: All asphaltic concrete mixtures (including leveling courses), other than adjacent to curb and gutter or other true edges, shall be laid by the string line method, to assure obtaining an accurate, uniform alignment of the pavement edge.
 - b. Temperature of Spreading: The temperature of the mixture at the time of spreading shall be within 25 degrees F of the temperature set by the Engineer of Record, which temperature shall be between 270 degrees F and 350 degrees F, unless otherwise directed.

- c. Rain and Surface Conditions: Any mixture caught in transit by sudden rain may be laid only at the Contractor's risk. Should such mixture prove unsatisfactory, it shall be removed and replaced with satisfactory mixture at the Contractor's expense. In no case shall the mixture be laid while rain is falling or when there is water on the surface to be covered.
- d. Number of Crews Required: For each paving machine being operated, the Contractor will be required to use a separate crew, each crew operating as a full unit.
- e. Checking Depth of Layer: The depth of each layer shall be checked at frequent intervals, not to exceed 25 feet. Any deviation from the required thickness, in excess of the allowable tolerance, shall be immediately corrected.
- f. Hand spreading: In limited areas where the use of the spreader is impossible or impracticable, the mixture may be spread and finished by hand.
- g. Straight-edging and Back-patching: straight-edging and backpatching shall be done after initial compaction has been obtained and while the material is still hot.

14.5.8.2 Requirements Applicable Only to Surface Courses

- a. Spreading and Finishing: Upon arrival, the mixture shall be dumped into the approved mechanical spreader and immediately spread and struck-off to the full width required, and to such loose depth for each course that, when the work is completed, the required weight of mixture per square yard, or the specified thickness, will be obtained. An excess amount of mixture shall be carried ahead of the screed at all times. Hand raking shall be done behind the machine as required.
- b. Thickness of Layers: Where a surface course is to be constructed to a thickness greater than two inches, it shall be constructed in approximately equal layers and no layer shall be more than two inches in thickness when compacted. Each layer shall be thoroughly compacted and shall conform to the requirements of these specifications before an additional layer is placed.
- c. Laying Width: If necessary due to traffic requirements, the mixture shall be laid in strips in such manner as to provide for the passage of traffic. Where the road is closed to traffic, the mixture may be laid to the full width, by machines traveling in echelon.
- d. Correcting Defects: Before any rolling is started the surface shall be checked, any irregularities adjusted, and all drippings, fat sandy accumulations from the screed, and fat spots from any source shall be removed and replaced with satisfactory material. No skin

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patching shall be done. When a depression is to be corrected while the mixture is hot, the surface shall be well scarified before the addition of fresh mixture.

14.5.8.3 Requirements Applicable Only to Leveling Courses

- a. Patching Depressions: Before any leveling course is spread, all depressions in the existing surface more than one inch deep shall be filled by spot patching with leveling course mixture and then thoroughly compacted.
- b. Work Adjacent to Bridge Ends: On resurfacing projects where the roadway joins an existing bridge and where necessary to insure that a bump will not be created by the overlay, before any surfacing is placed adjacent to the bridge, a portion of the existing pavement shall be bladed off, in order that a smooth transition between the new surfacing and the bridge end may be effected.
- c. Spreading Leveling Courses: The leveling shall be placed by the use of a paving machine, in good condition and appropriate for the project to be undertaken. Other types of leveling devices may be used, subject to prior approval by the Engineer of Record, with the concurrence of the Public Works Department.
- d. Rate of Application: When the total amount of leveling course material to be applied exceeds 50 pounds per square yard, it shall be applied in separate courses, with the average spread not to exceed 50 lbs. per square yard. When Type S-III Asphaltic Concrete is used for leveling, the average spread for each leveling course shall not be less than 50 pounds per square, nor more than 75 pounds per square yard. Unless otherwise indicated the quantity shown in the plans for leveling represents an average for the entire job. The rate of application of leveling may be increased or decreased, as necessary, at locations designated by the Engineer of Record. Where widening construction is specified in connection with leveling, the Engineer of Record may require that approximately fifty percent of the leveling be placed prior to the widening operation.
- e. Placing Leveling Over Existing Concrete Pavement: For leveling course to be applied over broken existing concrete pavement (with or without old asphaltic surface), the first course of the leveling shall be placed as soon after the cracking and reseating of the concrete as is practicable, but not later than two days after the cracking operations on any section. The remainder of the surfacing shall follow in the normal sequence of operations.
- f. Removal of Excess Joint Material: Where leveling is placed over concrete pavement or concrete deck-slab bridges, all excess joint filler at the cracks and joints shall be removed flush with the existing concrete prior to placing the leveling course.

14.5.9 Compacting Mixture

14.5.9.1 Provisions Applicable to All Types:

- a. Equipment and Sequence: For each paving or leveling train in operation, the Contractor shall furnish a separate set of rollers, with their operators. The rolling shall be done in the following sequence, with the equipment as shown, unless otherwise permitted by the Engineer of Record, with the concurrence of the Public Works Department.
 - (1) Seal rolling, using tandem steel rollers weighing 5 to 12 tons, and following as close behind the spreaders as is possible without pick-up, undue displacement or blistering of the material.
 - (2) Rolling with self propelled pneumatic-tired rollers, following as close behind the seal rolling as the mix will permit. The roller shall cover every portion of the surface with at least five passes.
 - (3) Final rolling with the 5 to 12 ton tandem steel rollers, to be done after the seal rolling and pneumatic-tired rolling have been completed, but before the pavement temperature has dropped below 175 degrees F.
- b. Compaction at Crossovers, Intersection, etc: When a separate paving machine is being used to pave the crossovers, the compaction of the crossovers may be done by one 5 to 10 ton tandem steel roller. If crossovers, intersections and acceleration and deceleration lanes are placed with the main run of paving, a traffic roller shall also be used in the compaction of these areas.

14.5.9.2 Rolling Procedures

The initial rolling shall be longitudinal. When the lane being placed is adjacent to a previously placed lane, the center joint shall be pinched or rolled, prior to the rolling of the rest of the lane.

After the rolling or pinching of the center joint, the rolling shall continue across the mat by overlapping each previous roller path by at least one-half the width of the roller wheel. The motion of the roller shall be slow enough to avoid displacement of the mixture, and any displacement shall be corrected at once by the use of rakes, and the addition of fresh mixture if required. Final rolling shall be continued until all roller marks are eliminated.

a. Speed of Rolling: Rolling with the self-propelled, pneumatic-tired rollers shall proceed at a speed of 6 to 10 miles per hour, and the area covered by each roller shall not be more than 4,000 square yards per

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- hour, except that for Type S Asphaltic Concrete, this maximum rate of coverage shall be 3,000 square yards per hour.
- b. Number of Pneumatic tired Rollers Required: A sufficient number of self-propelled pneumatic-tired rollers shall be used to assure that the rolling of the surface for the required number of passes will not delay any other phase of the laying operation nor result in excessive cooling of the mixture before the rolling is complete. In the event that the rolling falls behind, the laying operation shall be discontinued until the rolling operations are sufficiently caught up.
- c. Compaction of Areas Inaccessible to Rollers: Areas which are inaccessible to a roller (such as areas adjacent to curbs, headers, gutters, bridges, manholes, etc.,) shall be compacted by the use of hand tamps or other satisfactory means.
- d. Rolling Patching and Leveling Courses: Self-propelled pneumatic-tired rollers shall be used for the rolling of all patching and leveling courses.
- Correcting Defects: The rollers shall not be allowed to deposit gasoline, oil or grease onto the pavement, and any areas damaged by such deposits shall be removed and replaced as directed by the Engineer of Record. While rolling is in progress, the surface shall be tested continuously and all discrepancies corrected to comply with the surface requirements. All drippings, fat or lean areas and defective construction of any description shall be removed and replaced. Depressions which develop before the completion of the rolling, shall be remedied by loosening the mixture and adding new mixture to bring the depressions to a true surface. Should any depression remain after the final compaction has been obtained, the full depth of the mixture shall be removed and replaced with sufficient new mixture to form a true and even surface. All high spots, high joints and honeycomb shall be corrected as directed by the Engineer of Record. Any mixture remaining unbonded after rolling shall be removed and replaced. Any mixture which becomes loose or broken, mixed or coated with dirt or in any way defective, prior to laying the wearing course, shall be removed and replaced with fresh mixture, which shall be immediately compacted to conform with the surrounding area. Areas of defective surface may be repaired by the use of indirect heat. No method of repair involving open-flame heaters shall be used.
- f. Provisions Applicable to Shoulder Pavement Only: Shoulder pavements wider than three feet shall be compacted by the use of equipment of the type required for other asphaltic concrete pavements. Compaction of asphaltic concrete three feet or less in width, shall be done by the use of tandem steel rollers not exceeding 12 tons in weight. Other compaction in such restricted widths shall be by the use of any type of rubber-tired equipment the Contractor may elect to use, approved by the Engineer of Record, with the concurrence of the Public Works Department.

14.5.9.3 Density Required for Asphaltic Concrete Pavement: After final compaction, the density shall be at least 96% of the laboratory compacted density of the paving mixture for that day's production.

14.5.10 Joints

- 14.5.10.1 Transverse Joints: Placing of the mixture shall be as continuous as possible and the roller shall not pass over the unprotected end of the freshly laid mixture except when the laying operation is to be discontinued long enough to permit the mixture to become chilled. When the laying operation is thus interrupted, a transverse joint shall be constructed by cutting back on the previous run to expose the full depth of the mat.
- 14.5.10.2 Longitudinal Joints: Where only a portion of the width of pavement is to be laid and opened to traffic, longitudinal joints shall be formed by rolling the exposed edge of the strip first laid. When the adjacent strip is constructed, the Engineer of Record may require the edge of the mixture in place to be trimmed back to expose an unsealed or granular vertical surface. Where the strip first laid is closed to traffic, the edge shall not be sealed but shall be left vertical and the adjacent strip placed against it without trimming.
- 14.5.10.3 General: When fresh mixture is laid against the exposed edges of joints (trimmed or formed as provided above), it shall be placed in close contact with the exposed edge so that an even, well-compacted joint will be produced after rolling.

14.5.11 Surface Requirements

- 14.5.11.1 Checking with Rolling Straightedge: The final surface course of all pavements will be required to be checked by the rolling straightedge, in accordance with the following provisions. As soon as the rolling has been completed and the surface has hardened sufficiently to be walked on, the entire surface shall be checked with a rolling straightedge, set to indicate any surface irregularities in excess of 3/16 inch. The rolling straightedge shall have an effective length of 15 feet and its design shall meet the approval of the Engineer of Record. The rolling straightedge and labor for its operation shall be supplied by the Contractor. The straightedge shall be applied in lines parallel to the centerline, at least twice for each pass of the spreader. Straight-edging shall be extended across all joints. Any irregularities in excess of 3/16 inch shall be corrected by removing and replacing the defective sections or by overlaying with surface material, as directed by the Engineer of Record. Straight-edging of paved shoulders will not be required unless so directed by the Engineer of Record.
- 14.5.11.2 Manual Straightedge: A 15-foot manual straightedge shall be furnished by the Contractor and shall be available at all times on the work. The Contractor shall designate an employee whose duty it is to handle the straightedge in checking the compacted surfaces under the direction of the

- Engineer of Record, or if requested by a representative of the Public Works Department.
- 14.5.11.3 Permissible Variations from True Surface: The finished surface shall not vary more than 3/16 inch from the straightedge applied parallel to the centerline of the pavement. Any surface irregularities exceeding such limits shall be corrected in accordance with the requirements.
- 14.5.11.4 Texture of Finished Surface: The finished surface shall be of uniform texture and compaction. The surface shall have no pulled, torn or loosened portions, and shall be free of sand streaks, sand spots or ripples. These requirements shall also apply to any areas where it is necessary to apply hand work.
- 14.5.11.5 Any areas in which the surface does not meet the above requirements for texture, sand streaks, ripples, pulled or loosened portions, or for uniformity of compaction; or does not meet the straight-edging requirements, shall be corrected at the Contractor's expense. Such corrections may be made either by replacing the surface course (to full depth) or by overlaying with the type of asphaltic concrete mixture being placed. Within the longitudinal limits where such defective areas occur, such corrections shall be made for the full width of the roadway and for longitudinal distances in both directions beyond such defective areas in accordance with the following:
 - (a) If the correction is made by replacing of the full thickness, it shall extend to at least 50 feet each side of the defective area.
 - (b) If the Contractor elects to effect the correction by overlaying, the overlay shall consist of at least 100 pounds of mixture per square yard, at the defective section and shall taper uniformly down from the full thickness of such weight, to zero thickness, feathered, at the end of a minimum length of 50 feet each side of the defective area.
 - (c) The transverse thickness at any section shall be such as to provide the design cross section.
- 14.5.12 Protection of Finished surface: Sections of newly compacted asphaltic concrete which are to be covered by additional courses shall be kept clean until the successive course is laid.

Upon completion of the finished pavement, no dumping of any material directly on the pavement will be permitted. When shoulders are constructed after completion of the final surface, blade graders operating adjacent to the pavement during shoulder construction shall have a two inch by eight inch (or larger) board (or other attachment providing essentially the same results) attached to their blades in such manner that it extends below the blade edge, in order to protect the pavement surface from damage by the grader blade. Vehicular traffic shall not be permitted on any pavement which has not set sufficiently to prevent rutting or other distortion.

14.5.13 Other Requirements: All requirements outlined above may be supplemented by, substituted for or modified by the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction," latest edition, at the discretion of the Engineer of Record, with the concurrence of the Public Works Director.

SECTION 15 GRADING, EXCAVATING AND FILLING

15.1 GENERAL

15.2 MATERIALS

- 15.2.1 Fill Material
- 15.2.2 Materials for Sedimentation Control
- 15.2.3 Grassing

15.3 EXECUTION

SECTION 15 TRENCHING, BACKFILLING AND COMPACTING FOR UTILITIES

15.1 GENERAL

No person shall grade or fill any property within the City of Groveland municipal limits without authorization from the City of Groveland. Exemptions to this requirement are:

- 15.1.1 When approved by the Building Official and/or the City Engineer, grading in an isolated, self-contained area if there is no danger to private or public property and there is no additional runoff from the site, no change in the direction of the runoff patterns and no deviation from permit conditions.
- 15.1.2 An excavation below finished grade for basements and footings of a building, retaining wall or other structure authorized by a valid building permit.
- 15.1.3 Cemetery gravesites.
- 15.1.4 Refuse disposal sites controlled by other regulatory entities.
- 15.1.5 Excavation for wells, tunnels or utilities.
- 15.1.6 Mining, quarrying, excavating, processing, stockpiling of rock, sand, gravel, aggregate or clay where established and provided for by law, provided such operations do not affect the lateral support or increase the stresses in or pressure upon any adjacent or contiguous property.
- 15.1.7 Exploratory excavations under the direction of soil engineers or engineering geologists.
- 15.1.8 An excavation which (1) is less than two feet in depth, or (2) does not create a cut slope greater than 5 feet in height and steeper than I unit vertical to 1½ units horizontal.
- 15.1.9 Fill less than 1 foot in depth and placed on natural terrain with a slope flatter than 1 unit vertical in 5 units horizontal, or less than 3 feet in depth, not intended to support structures, which does not exceed 50 cubic yards on any one lot and does not obstruct a drainage course.

15.2 MATERIALS

15.2.1 Fill Material

Fill material shall be clean soil only and shall be free of any asphaltic concrete Portland cement concrete, boulders, metal, stumps, chemical contaminants, hazardous or toxic wastes or substances, radioactive or organic waste material, agricultural or industrial waste material, sludge or residues, drums or containers, trash, litter or debris of any kind.

15.2.2 Materials for Sedimentation Control

Materials for sedimentation control shall be commercially manufactured products for silt barriers, floating turbidity barriers and geotextiles, which comply with the requirements of the

applicable sections of the FDOT Standard Specifications. Hay bales may also be used where appropriate, if securely baled, properly installed and staked as shown in the standard details.

15.2.2 Grassing

Grassing shall match that of the surrounding areas. Seed, sod and mulch shall comply with FDOT Standard Specifications, Section 981. Fertilizer shall comply with FDOT Section 982 and water shall comply with FDOT Section 983

15.3 EXECUTION

- 15.3.1 Sedimentation control systems shall be in place prior to the start of any construction activities. These shall be inspected daily and shall be maintained in good order throughout the course of the construction.
- 15.3.2 All necessary and required City, County, State and Federal permits shall be submitted to the City prior to start of any grading, filling, excavating, dredging, and/or stockpiling.
- 15.3.3 Soil tracking prevention measures, including a gravel construction entrance shall be installed prior to the beginning of work.
- 15.3.4 Contractor must notify the Engineering Inspector 24 hours prior to start of any grading, excavating and/or filling operation.
- 15.3.5 Excavating must be carried out in the dry, to the extent possible. Water from dewatering activities must be properly contained and disposed of and shall not be allowed to runoff onto adjacent properties unless written permission is granted by the property owner. Proper sedimentation control features shall be in place around water discharge points. Where required, the contractor shall obtain a water management district dewatering permit before commencing.
- 15.3.6 Excavated materials shall be properly disposed. Disposal areas and fill areas must be approved by the City of Groveland. No excavated materials shall be disposed of or stockpiled without written permission of the property owner. The City shall be provided with a copy of the written approval prior to deposition of any materials.
- 15.3.7 If any muck or muck-like material is discovered, it will be required to be removed, backfilled with appropriate fill, compacted, and tested using AASHTO T-180/ASTM D-1557, Modified Proctor Method.
- 15.3.8 No burying of any organic materials is permitted.
- 15.3.9 All vegetation and topsoil must be removed prior to the filling of future roadway and lot areas. Topsoil shall be stockpiled for future use.
- 15.3.10 Any burning of any materials on-site must be approved and permitted by the Florida Division of Forestry.
- 15.3.11 Temporary fill stockpiling is not permitted in lifts greater than six feet and must be provided with sedimentation control measures.
- 15.3.12 Vegetated and undisturbed buffers at the base of the slope on the subject property may be utilized as an alternative to sediment fence.

- 15.3.13 Stockpiles that will remain in place in excess of 20 days shall be seeded and mulched immediately upon placement of final lift.
- 15.3.14 Fill is to be performed in one foot lifts, except for structures other than streets and sidewalks. For buildings and other structures, lifts shall be six inches. Compaction shall be 98% for paved areas and under structures and 95% for unpaved areas and future building pads as measured by AASHTO T-180/ASTM D-1557, Modified Proctor Test.
- 15.3.15 For filling of proposed lots in conjunction with site development, compaction tests shall be performed on the building lots at 300 foot intervals. The tests shall be performed in one foot vertical increments.
- 15.3.16 Results, certified by a licensed resting laboratory shall be submitted to the City upon completion of the tests.
- 15.3.17 Soils shall be stabilized using non-potable water or other means during construction to reduce soil erosion and impacts to neighboring sites. Contractor shall employ all necessary measures to control erosion and sedimentation including but not limited to, installation of silt fence, hay bales, and floating turbidity barriers.
- 15.3.18 Sediment fence shall be installed at the base of the disturbed area or stockpile where slopes exceed 5%.
- 15.3.19 No harmful or increased erosion, shoaling of channels or stagnant areas of water shall be created from grading, excavating or filling operations. No additional runoff shall result. There shall be no change in flow patterns or direction of runoff. No ditches, pipes or other runoff conveyances shall be blocked, diverted or otherwise impeded.
- 15.3.20 Once an area is seeded or sodded, the grass shall be maintained until a healthy stand of grass is established. Maintenance shall continue until at least the first mowing.